A Framework for Integrating Blockchain Technology into Copyright Theft Prevention Systems: A Case Study of the Uganda National Musicians Federation

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Declaration.

I Kasole Ahmed declare that this thesis is original and has never been submitted for a master's degree in this Institute or any other institution of higher learning or university for any award and should not be reproduced without my permission.

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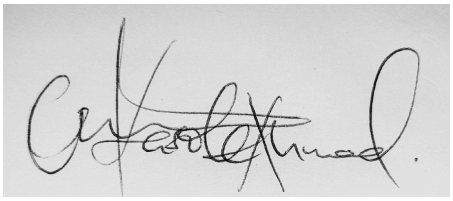

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Approval

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Dedication

This study is dedicated to my beloved family; mum, brothers and sisters whose unwavering support and encouragement have been my constant inspiration. Their belief in my aspirations fueled every step of this journey.

I also dedicate this work to the hardworking music legends of Uganda and the entire music sector. May this study contribute to a future where their creativity is fully protected, their efforts are justly rewarded, and their income generation is significantly enhanced.

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LIST OF ACRONYMS:

ACR	Automated Content Recognition
BCCF	Blockchain Copyright Compliance Framework
CIA	CIA Triad: Confidentiality, Integrity, and Availability
CMOs	Collective Management Organizations
CSF	Cybersecurity Framework
DOI	Diffusion of Innovations
DRM	Digital Rights Management
EAT	East African Time
EUIPO	European Union Intellectual Property Office
GDP	Gross Domestic Product
IFPI	International Federation of Phonographic Industries
IP	Intellectual Property
IPFS	InterPlanetary File System
NIST	National Institute of Standards and Technology
NFTs	Non-Fungible Tokens
ODRL	Open Digital Rights Language
OECD	Organisation for Economic Co-operation and Development
PKI	Public Key Infrastructure
PoS	Proof of Stake
PoW	Proof of Work
TAM	Technology Acceptance Model
UBOS	Uganda Bureau of Statistics
UCC	Uganda Communications Commission
ULRC	Uganda Law Reform Commission
UNCTAD	United Nations Conference on Trade and Development
UNMF	Uganda National Musicians Federation
UPRS	Uganda Performing Rights Society
URSB	Uganda Registration Services Bureau
WCT	Copyright Treaty
WIPO	World Intellectual Property Organization
ZKP:	Zero-Knowledge Proofs
ZTA	Zero Trust Architecture

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Abstract.

Uganda's vibrant creative economy, particularly its music industry, faces significant challenges from widespread copyright infringement and substantial revenue loss. This is primarily due to unauthorized digital distribution and the limitations of traditional enforcement methods in the digital age. Artists often find their work used without proper compensation, which stifles innovation and threatens the economic viability of creative professionals. This study aims to address these issues by conceptualizing and developing a blockchain-based framework to prevent copyright theft and enhance revenue tracking for artists under the Uganda National Musicians Federation. The framework is designed to revolutionize ownership verification and automate royalty distribution with unprecedented transparency, thereby restoring financial control to creators.

To achieve this, a qualitative case study was conducted at the Uganda National Musicians Federation (UNMF). The methodology involved in-depth interviews with musicians, producers, and federation staff to understand their lived experiences of copyright abuse and the challenges in licensing. This empirical data was supported by a comprehensive literature review on copyright enforcement and blockchain integration in the creative industries. To demonstrate feasibility, a simulation model was built using Hyperledger Fabric, which was tested in realistic content distribution scenarios to show how smart contracts could seamlessly register content, automate agreements, and ensure timely royalty payments directly to creators.

The findings confirm that blockchain technology can effectively secure content ownership with cryptographic certainty, track usage in real-time, and reduce dependency on intermediaries. Based on these insights, the study proposes a comprehensive Blockchain Copyright Compliance Framework (BCCF) customized for Uganda. This framework outlines processes for decentralized content registration, smart contract-based licensing, and inter-agency collaboration. The study concludes that while blockchain offers immense potential for copyright governance and revenue protection, its successful implementation will require a multi-faceted approach involving legal reform, stakeholder buy-in, and technical capacity-building initiatives

CHAPTER ONE

INTRODUCTION

Uganda's creative sector, a burgeoning economic and cultural powerhouse, has been under threat from rampant copyright infringement. The systematic piracy of music, literature, film, and visual arts has been eroding the livelihoods of creators and impeding innovation. This directly contradicted the goals of Uganda's Vision 2040, which emphasized the development of a knowledge-based economy, with the creative industries as a key component (National Planning Authority, 2013).

A knowledge-based economy thrives on intellectual property, research, technology, and innovation, enabling economic diversification and global competitiveness (World Bank, 2021). In Uganda, the creative industries have contributed significantly to employment, cultural heritage preservation, and national branding. However, the growth and potential of these industries were significantly hampered by copyright theft, which constituted the unauthorized reproduction, distribution, or adaptation of creative works without the consent of the copyright holder (World Intellectual Property Organization, 2022). Copyright infringement in Uganda took various forms, including unauthorized music downloads, film piracy, counterfeit books, and unlicensed digital streaming.

The magnitude of this issue was severe, with the World Statistics Organisation estimating annual financial losses in Uganda’s creative economy to be between US20millionandUS30 million due to piracy and intellectual property violations. This loss of revenue not only affected individual creators but also stifled investment and limited the broader economic impact of the creative industries (World Statistics Organisation, 2023). The Uganda National Musicians Federation (UNMF), representing a significant portion of the music industry, has been at the forefront of advocating for stronger copyright protection measures. Despite their efforts, the challenges posed by copyright infringement remained substantial. For example, Uganda has legal frameworks such as the Copyright and Neighbouring Rights Act of 2006, but their enforcement has remained weak, allowing piracy to persist (Uganda Registration Services Bureau, 2021).

1.1 Background to the Study

Uganda's creative economy has experienced significant growth in recent years, contributing to employment, cultural identity, and economic diversification. The creative sector has contributed approximately 3% to Uganda's GDP and provided thousands of jobs, particularly for youth and women (UBOS, 2021). Moreover, the sector has played a crucial role in shaping Uganda's global image and fostering cultural diplomacy.

Despite its potential, Uganda's creative economy faced a significant hurdle due to rampant copyright theft, a problem that was not unique to the country. Globally, copyright infringement has become a pervasive issue, with estimates suggesting annual losses in the billions of dollars (Kevin, 2020). For instance, in the United States, the Motion Picture Association of America reported losses of approximately $29 billion due to piracy in 2021 (U.S. Chamber of Commerce, 2019). Similarly, in Nigeria, the Nigerian Copyright Commission has highlighted the significant impact of piracy on the country's creative industries.

In Uganda, various forms of copyright infringement existed, ranging from unauthorized music downloads and film piracy to counterfeit books and unlicensed digital streaming (Asekenye Frances, 2019). Music was illegally downloaded and shared online, bypassing legitimate distribution channels. Authors saw their books pirated and sold on street corners, while movies were illegally streamed or copied onto physical media. These acts not only deprived creators of rightful compensation but also discouraged investment in new works, hindering the growth of the creative sector. For instance, 82% of Ugandan creators had experienced copyright infringement, with online piracy (78%) and physical copying (52%) being the most common methods (Nabukenya & Mugisha, 2020). This aligned with global trends, where digital piracy has become increasingly prevalent due to advancements in technology and the widespread availability of high-speed internet. Additionally, Kaggwa (2021) noted that 45% of creators lacked awareness of existing copyright protection mechanisms, underscoring the need for increased education and outreach efforts.

Several technological solutions have been developed globally to combat copyright infringement. For example, Digital Rights Management (DRM) systems have been widely used to prevent unauthorized access to digital content, but they were costly and often bypassed by hackers. Content ID systems, such as those used by YouTube, detected copyrighted material in uploaded videos and allowed rights holders to monetize or remove infringing content. However, these systems were primarily controlled by major corporations and did not always benefit independent artists. Other solutions, such as watermarking and fingerprinting technologies, have been used to track unauthorized content distribution, but they were limited in effectiveness due to manual enforcement challenges.

Uganda implemented several measures to combat copyright theft and protect the rights of creators, including the enactment of the Copyright and Neighbouring Rights Act. This legislation was designed to provide a legal framework for protecting intellectual property and penalizing piracy. Additionally, public awareness campaigns were launched to educate both creators and the public about the importance of respecting copyright laws. Regulatory bodies like the Uganda Registration Services Bureau (URSB) were also established to oversee intellectual property registration and enforcement. However, these efforts were largely ineffective due to weak enforcement, insufficient resources, and limited public awareness (URSB, 2021).

It was against this background that this study proposed and developed a blockchain-based framework specifically designed to combat copyright theft and recover lost revenue within Uganda's creative economy, with a particular focus on the music industry as exemplified by the Uganda National Musicians Federation. Blockchain technology offered a decentralized and tamper-proof digital ledger that ensured transparent ownership tracking and automatic enforcement of copyright rights. Through smart contracts, the framework enabled automatic royalty distribution, ensuring that creators received fair compensation whenever their work was used. Blockchain Technology supported a secure and transparent system for copyright ownership and distribution; therefore, this has empowered Ugandan creators to protect their works, ensure proper attribution, and ultimately recover the financial losses incurred due to piracy.

1.2 Problem Statement

Uganda's creative sector, a vibrant hub for music, literature, film, and visual arts, has played a crucial role in the country's economic growth and cultural identity. The sector provides employment to thousands and contributes significantly to Uganda's GDP (Uganda Bureau of Statistics, 2021). However, despite its potential, the industry faces a significant challenge in the form of widespread copyright infringement. Copyright infringement in Uganda takes multiple forms, including unauthorized reproduction, online piracy, illegal distribution of physical copies, and unlicensed public performances (Asekenye Frances, 2019). Music is illegally downloaded and shared online, books are photocopied and sold without permission, and films are copied onto discs or streamed without proper licensing. A survey revealed that 82% of Ugandan creators have experienced copyright infringement, with online piracy (78%) and physical copying (52%) being the most common methods (World Statistics Organisation, 2023).

Despite the legal protections offered by the Copyright and Neighbouring Rights Act of 2006, enforcement remains a major challenge. Traditional copyright enforcement methods, such as physical raids and manual inspections, are ineffective in the digital age, where content is easily duplicated and shared instantly online. The Uganda Police Force, which is responsible for enforcing these laws, often lacks the technical expertise and resources required to combat online piracy effectively (Namara, 2021). Additionally, public awareness about copyright protection remains low, with 45% of creators unaware of the mechanisms available to safeguard their work (Kaggwa, 2018). Also, several technological solutions have been developed globally to address copyright infringement, including Digital Rights Management (DRM) systems, watermarking techniques, and automated content recognition (ACR) software (IFPI, 2022). However, these systems have limitations, such as high implementation costs, vulnerability to hacking, and difficulty in tracking unauthorized content once it has been shared across multiple digital platforms.

This study therefore proposed and developed a blockchain-based framework tailored to Uganda's music industry, specifically addressing copyright theft and revenue recovery for artists under the Uganda National Musicians Federation. Blockchain technology, on the other hand, offers a

potential breakthrough by providing an immutable and decentralized method of recording ownership and transactions, ensuring that creators receive their rightful earnings. The framework established secure digital ledgers for copyright registration and automated royalty distribution through smart contracts. Unlike existing enforcement mechanisms, blockchain technology ensures tamper-proof ownership records, transparent tracking of content usage, and automated payment systems that reduce dependence on intermediaries.

1.3 Purposes/Objectives

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1.3.1 Main Objective

The study aimed to develop a framework for integrating blockchain technology into copyright theft prevention systems, focusing specifically on the Uganda National Musicians Federation.

1.3.2 Specific Objectives

I. To investigate the challenges faced by members of the Uganda National Musicians Federation in preventing copyright theft, and to derive requirements for a blockchain-based framework.
II. To design a blockchain-based framework for integrating blockchain technology into copyright theft prevention systems for the Uganda National Musicians Federation.
III. To test the developed framework for its effectiveness in preventing copyright theft within the context of the Uganda National Musicians Federation.

1.4 Research Questions

This study sought to address the following key research questions:

I. What are the key challenges faced by members of the Uganda National Musicians Federation in preventing copyright theft and revenue loss?

II. Based on the identified challenges, what are the technical and functional requirements for a blockchain-based framework to address copyright protection and revenue recovery in Uganda's music industry?
III. How can a blockchain-based framework be designed to integrate into the copyright theft prevention systems of the Uganda National Musicians Federation?
IV. How effective is the developed blockchain-based framework in preventing copyright theft and improving revenue generation for Ugandan music creators within the Uganda National Musicians Federation?

1.5 Scope of the Study

This study primarily focused on copyright infringement and protection mechanisms within Uganda's music industry, with a particular emphasis on the Uganda National Musicians Federation (UNMF) as a case study. The study analyzed the extent of piracy, the effectiveness of existing copyright laws, and the challenges faced by artists in protecting their intellectual property. The research was conducted within the context of Uganda's digital and legal landscape, evaluating how technological solutions such as blockchain technology could be integrated within current regulatory frameworks to enhance copyright protection and revenue recovery.

The UNMF was chosen as a case study because it represented a large segment of Uganda's music industry and played a crucial role in advocating for musicians' rights, negotiating industry standards, and pushing for stronger copyright protections (Kiyingi, 2022). Despite its advocacy efforts, the UNMF faced significant challenges, including widespread piracy, weak enforcement of copyright laws, and limited technological infrastructure to protect digital music distribution. This study investigated how blockchain could provide a technologically sound, transparent, and decentralized solution to these challenges.

1.5.1 Geographical Scope

The geographical scope of this study was Uganda, with a specific focus on major urban centers like Kampala, Jinja, and Mbarara, where a significant portion of the music industry operated and

the effects of copyright infringement were most pronounced. Kampala, as the country's economic and creative hub, was home to many of Uganda's top musicians, music producers, and digital distribution platforms, making it an ideal location for this research (Nsereko, 2021).

The study worked closely with the Uganda National Musicians Federation (UNMF) and its members to collect primary data on copyright infringement, existing protection mechanisms, and the feasibility of blockchain adoption in the Ugandan context. The focus on urban areas was informed by literature indicating that piracy hotspots were more prevalent in cities due to higher internet penetration, easier access to pirated content, and the presence of informal markets that facilitated copyright violations (Mwesigwa, 2020).

1.5.2 Content Scope

This study investigated the persistent issue of copyright infringement within Uganda's music industry, with a specific focus on the Uganda National Musicians Federation (UNMF) as the primary case study. The research delved into the multifaceted nature of copyright violations, including unauthorized digital distribution, illicit downloading, and physical piracy. These infringements have led to significant financial losses and legal uncertainties for content creators and rights holders in Uganda (Musungu & Dutfield, 2003; WIPO, 2020).

A central component of this study was the proposed use of blockchain technology as an innovative tool for strengthening copyright protection and revenue recovery. Blockchain, characterized by its immutability, transparency, and decentralized structure, offered a viable solution for secure music copyright registration, accurate attribution, and automated royalty distribution through smart contracts (Tapscott & Tapscott, 2016; Reyna et al., 2018). The study examined how such a system could be adapted and implemented in Uganda's context to curb infringement and enhance the efficiency of intellectual property management.

Furthermore, the research critically evaluated the existing legal and institutional frameworks governing copyright protection in Uganda, such as the Copyright and Neighbouring Rights Act (2006) and the enforcement mandates of URSB and UCC. Their effectiveness in addressing modern forms of piracy and supporting musicians under UNMF was assessed to identify legal

gaps and opportunities for reform (Uganda Law Reform Commission, 2019).

A stakeholder analysis was also conducted, involving interviews and engagements with musicians, producers, digital distributors, copyright lawyers, and policy makers. Particular emphasis was placed on the role and perspectives of members within the UNMF. Their experiences and insights informed the feasibility and design of a blockchain-based copyright management framework tailored to Uganda's music ecosystem, specifically for copyright protection and revenue recovery.

1.6 Significance

This study aimed to develop a blockchain-based framework to combat copyright theft in Uganda's music industry, with a focus on musicians under the Uganda National Musicians Federation (UNMF). By leveraging blockchain technology, the framework provided a secure and transparent system for copyright ownership and revenue recovery, ensuring that creators received fair compensation for their work.

The developed system established a tamper-proof digital record of ownership, reducing unauthorized use of creative works. Additionally, smart contracts facilitated automated royalty distribution, minimizing disputes over earnings and ensuring that musicians benefited directly from their intellectual property. The framework also enabled the UNMF to monitor copyright infringement more effectively, track unauthorized usage in real time, and take legal action where necessary.

By strengthening copyright protection and promoting fair compensation, this study supported the growth of Uganda's creative economy. It aligned with Vision 2040's goal of fostering intellectual property rights and innovation to drive sustainable development (National Planning Authority, 2013). The findings from this research provided a technological and policy-based approach to addressing piracy, contributing to a more robust and resilient creative sector in Uganda.

CHAPTER TWO

LITERATURE REVIEW

2.0 Chapter Overview

This chapter provides a comprehensive literature review addressing copyright protection and revenue recovery in Uganda's music industry, beginning with an examination of the current copyright landscape, including legal provisions, challenges in enforcement, and the impact of digital platforms. It then delves into the manifestations and prevalence of copyright theft, its root causes, and its impact on creator trust. The review progresses to analyze traditional and modern approaches to combating copyright theft, critically evaluating their efficacy and limitations before exploring the emergent potential of blockchain technology for copyright protection. The chapter concludes by outlining the theoretical frameworks underpinning the study, specifically the CIA Triad, Digital Rights Management (DRM) aligned frameworks, and advanced cryptographic tools, along with security architectural frameworks like NIST CSF and ZTA, and lessons from global and African blockchain implementations in copyright systems.

2.1 The Copyright Landscape in Uganda

Uganda's broader intellectual property (IP) regime is designed to foster innovation and creativity across various sectors, recognizing IP rights as crucial for economic development. Within this framework, copyright protection is predominantly governed by the Copyright and Neighbouring Rights Act of 2006 (Uganda Registration Services Bureau [URSB], 2019). This legislation was enacted to provide a comprehensive legal basis for safeguarding intellectual property rights across various creative sectors, including literary, musical, artistic works, computer programs, and electronic data banks. The Act delineates the rights of creators, specifies the duration of protection for copyrighted works, and outlines mechanisms for their enforcement. The legislative intent was to cultivate an environment conducive to artistic creation and innovation by ensuring

creators could benefit from their original works (Uganda Law Reform Commission [ULRC], 2022).

2.1.1 Key Provisions of the Copyright and Neighbouring Rights Act, 2006

The Copyright and Neighbouring Rights Act of 2006 serves as the cornerstone of copyright law in Uganda, replacing the earlier Copyright Act of 1964 to address the evolving landscape of intellectual property. The Act bestows creators with a suite of exclusive rights, allowing them to control various aspects of their work. These include:

- Reproduction Rights: The exclusive right to make copies of the work in any form (Section 9).
- Distribution Rights: The right to distribute or make available to the public the original or copies of the work (Section 9).
- Public Performance Rights: The right to perform the work in public (Section 9), crucial for musicians and dramatists.
- Communication to the Public: Encompassing broadcasting and other forms of public transmission (Section 9).
- Adaptation Rights: The right to make adaptations or translations of the work.

The Act extends copyright protection to a wide array of original works, provided they are expressed in material form, including literary works (books, articles, computer programs), dramatic works, musical works, artistic works (paintings, sculptures, photographs), audiovisual works, and sound recordings (Section 5). Importantly, the Act also recognizes moral rights (e.g., the right to be identified as the author and the right to object to derogatory treatment of the work), which remain with the creator even if economic rights are transferred (Section 10). The general duration of copyright protection for most works is the life of the author plus fifty years after their death (Section 13).

The Act also specifies offenses and infringements, outlining penalties for violations of copyright and neighboring rights, including fines and imprisonment (Native Law Uganda, 2024). The

Uganda Registration Services Bureau (URSB) is mandated with the administration of intellectual property rights, including copyright, and acts as the Registrar of Copyrights and Neighboring Rights (URSB, 2019). Creators are encouraged to register their works with the URSB, although copyright protection automatically vests upon creation, registration provides stronger evidence of ownership in disputes.

2.1.2 Challenges in Enforcement and Operationalization of Copyright.

Despite the clear stipulations of the 2006 Act, empirical evidence and industry reports consistently indicate that copyright infringement remains rampant across Uganda's creative industries, inflicting substantial economic detriment upon individual creators and the broader creative economy (Asekenye, 2019; Namara, 2021). The effective enforcement of copyright law in Uganda is significantly hampered by a confluence of systemic challenges as discussed in the following subsections.

Legal Gaps and Outdated Provisions: While the 2006 Act was a significant step forward, technological advancements since its enactment, particularly the explosion of digital content creation and distribution, have introduced complexities not fully anticipated by the law (ULRC, 2022). For instance, specific provisions regarding online piracy, digital streaming, and the intricacies of blockchain-based rights management were not within the scope of consideration at the time of drafting. The Uganda Law Reform Commission (ULRC) has acknowledged these gaps and is actively reviewing the Act to address emerging issues, strengthen protection, enhance enforcement, and ensure better remuneration for copyright holders, including proposals for private copying levies and stronger penalties (ULRC, 2022). Uganda's recent accession to international treaties like the WIPO Copyright Treaty (1996) and the Beijing Treaty on Audiovisual Performances (2012) in January 2022 also necessitates domestic legal alignment (Native Law Uganda, 2024).

Institutional Capacity and Resource Constraints: The URSB, while the national IP office, faces significant challenges in its mandate to administer and enforce copyright. These include limited financial resources, inadequate human resources (particularly specialized IP staff), and a lack of advanced technical expertise necessary to effectively track, investigate, and prosecute digital

piracy. While the URSB has made progress in other areas like business and trademark registration, and is moving towards automating copyright registration (URSB Annual Report, 2024), the sheer volume and dynamic nature of digital infringement overwhelm existing capacities. The Uganda Police Force, often the first point of contact for enforcement, also lacks specialized units and training for IP crimes.

Judicial Process and Remedies: The legal recourse for copyright infringement through the Ugandan court system is often protracted, costly, and procedurally complex. IP litigation can be lengthy and expensive, posing substantial barriers for individual creators who typically lack the financial means to sustain prolonged legal battles (Panaf, 2023). Furthermore, judges and legal practitioners may not always possess deep specialization in the nuances of intellectual property law, leading to inconsistent application or delays in judgment. Remedies, while available (e.g., injunctions, damages, account for profits), may not always fully compensate creators for their losses or effectively deter future infringements (MMAKS Advocates, n.d.).

Public Awareness and Education: A pervasive lack of public awareness regarding copyright laws persists among both creators and the general public (Kaggwa, 2018; UNCTAD, n.d.). Many artists, even well-known ones, reportedly do not fully understand how to properly register copyrights, negotiate licensing deals, or collect royalties (Nile Post, 2025). Among the general populace, there is often a perception that illegal downloading or sharing of content is harmless, or even a form of cultural promotion, rather than a direct infringement of rights. This knowledge gap contributes significantly to the proliferation of piracy and undermines efforts to build a culture of respect for intellectual property (The Observer, n.d.).

2.1.3 The Impact of Digital Platforms to the copyright landscape of Uganda.

The rapid rise and widespread adoption of digital platforms have profoundly complicated the landscape of copyright enforcement. With ubiquitous internet access and the ease of digital media replication, pirated content can now be disseminated with unprecedented speed and global reach (World Statistics Organisation, 2022). This paradigm shift inherently reveals the inadequacy of traditional enforcement mechanisms, such as physical inspections and raids, which were originally conceived for an era dominated by the distribution of physical media (Namara, 2021).

Such conventional approaches are inherently reactive, geographically limited, and ill-equipped to combat the instantaneous and borderless nature of digital piracy.

Ugandan artists have particularly struggled with the digital shift, finding it difficult to track usage of their music on streaming platforms, radio, TV, and public venues, leading to significant uncollected royalties (Panaf, 2023). The recent approval of a Copyright Management System (CMS) by the Ugandan President aims to address some of these digital challenges by registering musicians' works, tracking usage in commercial venues, and automating royalty payments (The Independent Uganda, 2025). This move signifies a recognition of the urgent need for technologically enhanced solutions to complement the existing legal framework.

The persistent problem of copyright theft in Uganda, compounded by the complexities of the digital environment, emphatically underscores the urgent need for more robust, scalable, and innovative solutions that extend beyond the confines of existing legal and regulatory frameworks. Relevant theoretical frameworks from information systems and innovation literature offer valuable insights into potential technology adoption pathways. The Technology Acceptance Model (TAM) (Davis, 1989) posits that the perceived usefulness and perceived ease of use are crucial determinants of an individual's acceptance and adoption of new technology. For a novel system like a blockchain-based framework to gain traction in Uganda, creators and stakeholders must perceive it as genuinely beneficial in protecting their work and recovering revenue, while also being user-friendly. Similarly, Diffusion of Innovations (DOI) theory (Rogers, 2003) suggests that for new technologies to be successfully integrated, they must offer clear relative advantages over existing methods, be compatible with current industry practices, be easily observable in their benefits, and be accessible for trialability by stakeholders. By critically considering these factors, this study explores how a blockchain-based framework can transcend the limitations of current systems, providing a more secure, transparent, and efficient mechanism that directly addresses the unique challenges of copyright protection and revenue recovery in Uganda.

2.2 Copyright Theft and Its Prevalence

Copyright theft, characterized by the unauthorized reproduction, distribution, public performance, or adaptation of creative works without the consent of the copyright holder, represents a significant and persistent impediment to the sustainable growth of Uganda's vibrant creative economy (Asekenye, 2019; URSB, 2019). Its prevalence has been profoundly intensified by the rapid proliferation of digital technology, which has significantly lowered the technical and logistical barriers to illicitly copying and distributing content on a mass scale. Scholarly assessments and industry reports consistently highlight that weak enforcement of existing copyright laws has been a primary contributor to the widespread availability of unauthorized digital content, resulting in substantial and quantifiable financial losses for creators and other industry stakeholders (Asekenye, 2019; Namara, 2021). These economic losses fundamentally undermine artists' ability to derive a livelihood from their creative endeavors, consequently discouraging further creative production and stifling much-needed investment in Uganda's creative economy (Nile Post, 2025).

2.2.1 Manifestations and Scale of Copyright Theft in Uganda

Copyright theft in Uganda takes various forms, each contributing to the erosion of creators' economic rights:

Digital Piracy: This is the most pervasive form in the contemporary landscape, facilitated by widespread internet access and mobile technology. It includes unauthorized downloads from illegal websites, illicit streaming services, peer-to-peer file sharing, and the widespread use of pirated content on social media platforms (Namara, 2021). Music, films, and software are particularly vulnerable to digital piracy. The ease with which digital files can be replicated and shared globally makes this form of infringement exceedingly difficult to control using traditional methods.

Physical Piracy: Despite the digital shift, the market for pirated physical copies, such as CDs, DVDs, and flash drives containing unauthorized music and movies, remains significant, particularly in informal markets (Monitor, 2021). These pirated physical copies are often sold at considerably lower prices than legitimate products, undercutting legal sales and severely impacting retail channels (Muwado, 2024).

Unlicensed Public Performance and Broadcasting: A major issue, especially for musicians, is the widespread use of their copyrighted works in public venues (e.g., bars, clubs, events) and by broadcast media (e.g., radio, television) without proper licensing or royalty payments (KAA, 2025). While collective management organizations (CMOs) like the Uganda Performing Rights Society (UPRS) exist to collect and distribute these royalties, their effectiveness is often hampered by difficulties in monitoring usage, collecting fees, and ensuring accurate distributions (Panaf, 2023). Many artists report not receiving their due royalties from these sources (Monitor, 2021).

The scale of copyright infringement in Uganda is alarming. Although precise, comprehensive data remains challenging to acquire due to the clandestine nature of piracy, various reports provide estimations. A 2018 report by the URSB estimated that piracy of creative goods and services costs Uganda approximately UGX 400 billion (equivalent to approximately USD 110 million) each year (Muwado, 2024). Such figures underscore the significant economic drain on the national economy and individual livelihoods. The International Federation of Phonographic Industries (IFPI) has also consistently highlighted that a substantial proportion of music consumed in developing countries originates from pirated sources (IFPI, 2022). For Ugandan artists, this translates to a situation where, as reported by the General Secretary of UPRS, James Wasula, musicians may lose "almost 100 percent of sales to piracy" (Monitor, 2021). For example, while a hit album might have once generated significant revenue from sales, rampant duplication means such earnings are now a rarity (Monitor, 2021). This pervasive loss of revenue underscores a critical research gap in understanding the precise economic impact of digital piracy on individual artists' livelihoods and the broader creative economy in Uganda, beyond aggregate estimates.

2.2.2 Root Causes of High Incidence of Copyright Theft in Uganda.

The persistently high incidence of copyright theft in Uganda is attributable to several interconnected and mutually reinforcing factors:

Limited Public Awareness of Copyright Laws: A fundamental contributing factor is the pervasive lack of comprehensive understanding of copyright laws among both the general populace and

even many creators themselves (Kaggwa, 2018; Nile Post, 2025). There is often a misconception that digital content, once available online, is free for all to use and share without consequence. This cultural context often normalizes infringement, as many individuals do not perceive illegal downloading or sharing as a criminal act or a direct theft of intellectual property. Music executive Vickash Beni Kat has emphasized that this "knowledge gap has allowed piracy to thrive and limits the ability of creatives to fully commercialize their work" (Nile Post, 2025). This educational gap represents a significant area for intervention and a core knowledge gap preventing effective copyright protection.

Affordability and Accessibility of Pirated Content: Economic factors play a crucial role. Pirated materials are typically offered at significantly lower prices than legitimate products, making them highly attractive to consumers in a country with prevalent low-income levels (Monitor, 2021). For example, an original music CD costing UGX 5,000-10,000 might compete with a pirated replica sold for UGX 1,000 (Monitor, 2021). This affordability, coupled with the ease of accessing pirated content online or through informal physical markets, creates a powerful incentive for consumers to opt for illicit sources (Kaggwa, 2018). The economic disparity between legitimate and pirated content highlights a market-based gap that existing solutions have failed to address effectively.

Challenges in Enforcement and Resource Constraints: As discussed in Section 2.1.2, law enforcement agencies in Uganda, including the URSB and the Police, face considerable resource constraints, including inadequate funding, insufficient specialized personnel, and a distinct lack of advanced technical expertise required to effectively track, investigate, and prosecute copyright infringers, particularly in the complex digital domain (Namara, 2021; URSB, 2019). The sheer volume of digital infringement cases overwhelms existing enforcement capabilities, leading to a low rate of successful prosecutions and a diminished deterrent effect (ResearchGate, 2024). This operational limitation represents a clear gap in the capacity of existing institutions to combat modern piracy.

Weak Deterrents and Judicial Processes: The perceived weak sanctions within the Copyright and Neighbouring Rights Act of 2006, coupled with the often slow, costly, and complex judicial

processes, further reduce the incentive for rights holders to pursue legal action (ULRC, 2022; Panaf, 2023). Even when cases are filed, the time and financial commitment required for litigation are often prohibitive for individual artists, leading to a sense of helplessness and resignation within the creative community. This identifies a procedural and systemic gap within the legal system that fails to provide timely and accessible justice for copyright holders.

2.2.3 Impact on Creator Trust and Creative Economy

Beyond direct financial losses, widespread copyright theft has profound negative impacts on the fundamental trust and confidence of creators in Uganda's existing copyright protection system. This erosion of confidence can lead to artists becoming disengaged, demotivated, and reluctant to invest further their time, talent, and resources in creative endeavors, knowing that their work may be stolen with little recourse (Leppard Law, n.d.). This directly undermines the spirit of innovation and entrepreneurship essential for a thriving creative economy.

Traditional methods of combating piracy, such as legal action and direct enforcement by the URSB, have consistently proven ineffective in keeping pace with the challenges of the digital era (Asekenye, 2019). These methods are typically characterized by their inherent slowness, high associated costs, and inability to manage the rapid and decentralized dissemination of pirated content online. The significant temporal lag between an infringement occurring and any legal redress being achieved often means that substantial financial and reputational damage has already occurred, rendering post-factum remedies largely insufficient. This overall ineffectiveness of existing mechanisms represents a significant research gap in finding sustainable, real-time, and efficient solutions for copyright enforcement and revenue recovery in the digital age within Uganda. This situation emphatically underscores the urgent necessity for more innovative, technologically advanced, and adaptable approaches to copyright protection, specifically those capable of addressing the unique and rapidly evolving challenges posed by digital piracy within Uganda's dynamic creative industry.

2.3 Traditional Approaches to Combating Copyright Theft

Traditional methods for enforcing copyright in Uganda have predominantly relied on legal frameworks and institutional mechanisms that were largely conceived for a pre-digital era. These approaches typically involve initiating legal action through the national courts, enforcement efforts by the Uganda Registration Services Bureau (URSB), and sporadic interventions by the Uganda Police Force (URSB, 2021). While these mechanisms do offer a foundational layer of protection for intellectual property, their efficacy has been frequently undermined by various inherent challenges, especially in the face of evolving digital technologies.

2.3.1 Legal and Institutional Enforcement Mechanisms

Historically, Uganda's approach to copyright enforcement has been rooted in the principles of common law and statutory provisions, primarily articulated in the Copyright and Neighbouring Rights Act of 2006 (Native Law Uganda, 2024). This Act provides the legal basis for aggrieved parties to seek redress through the judiciary. The URSB is mandated with the administrative oversight of intellectual property rights, including the registration of copyrighted works and serving as a point of contact for infringement complaints (URSB, 2019). Its role often involves educating the public on IP matters and facilitating the legal process for creators. The Uganda Police Force is also involved in enforcing copyright laws, typically through investigations, raids on premises suspected of producing or distributing pirated materials, and making arrests (Monitor, 2021). These actions are usually reactive, triggered by complaints from rights holders or intelligence gathering.

2.3.2 Inherent Limitations of Traditional Approaches

Despite their foundational importance, these traditional methods have proven increasingly inadequate in combating contemporary copyright theft, particularly given the shift to digital platforms. Several significant limitations have been identified:

Lengthy and Costly Legal Procedures: Pursuing copyright infringement cases through the Ugandan court system is notoriously protracted and expensive (Panaf, 2023). The complexity of intellectual property law, combined with judicial backlogs and the need for specialized legal expertise, means that cases can drag on for years. This imposes an insurmountable financial

burden on individual creators and small-scale creative enterprises, who often lack the resources to sustain prolonged litigation. Even if a case is won, the damages awarded may not fully cover the lost revenue or legal costs, making legal action a disincentive rather than a practical solution (MMAKS Advocates, n.d.). This identifies a critical procedural gap in accessing justice for creators.

Difficulties in Tracking Online Infringers: Traditional enforcement mechanisms were not designed for the global, decentralized nature of the internet. Authorities face significant difficulties in identifying and tracking online infringers, especially when they operate across borders or use anonymizing technologies (Namara, 2021). Pinpointing the source of digital piracy, gathering sufficient evidence, and coordinating across jurisdictions prove challenging for national agencies with limited international reach and technical capabilities. This highlights a major technological and jurisdictional gap in current enforcement.

Limited Enforcement Capabilities Beyond Borders: While international treaties exist (e.g., WIPO Copyright Treaty), their enforcement heavily relies on the domestic legal and institutional capacities of individual countries. Uganda's enforcement agencies have limited practical capabilities to pursue infringers operating from outside its national borders (URSB, 2021). This cross-border nature of digital piracy means that even if a local source is shut down, pirated content can quickly resurface from servers or distributors in other jurisdictions, rendering local efforts insufficient. This exposes a significant gap in cross-border enforcement coordination and capacity.

As articulated by Lawrence Lessig in his seminal work, *Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity* (2004), outdated legal frameworks consistently struggle to adapt to the rapid pace of technological advancements, leaving creators vulnerable to widespread copyright infringement. This observation is particularly pertinent in Uganda, where existing legal and regulatory systems have not sufficiently evolved to comprehensively address the complexities of digital piracy. The persistent failure of these traditional models has resulted in ongoing financial losses for creators and has not established a

deterrent strong enough to curb rampant piracy within the creative sector (Asekenye, 2019; Muwado, 2024).

2.3.3 Shortcomings of Conventional Approaches

The shortcomings of these conventional approaches are particularly evident in their inability to manage the rapid and decentralized dissemination of pirated content through digital channels. The pervasive lack of adequate resources and specialized expertise within enforcement agencies to effectively implement copyright laws, coupled with jurisdictional complexities inherent in a globalized digital environment, further diminish the effectiveness of efforts to protect intellectual property (URSB, 2021; Wasula, 2021, on challenges faced by UPRS in collecting royalties for artists). Consequently, traditional methods have largely been reduced to a reactive rather than a proactive stance against piracy.

2.4 Modern Approaches to Copyright Protection

In response to the documented limitations and growing ineffectiveness of traditional methods, the landscape of copyright protection has witnessed the introduction of several technological advancements aimed at combating copyright theft. These "modern" approaches, while offering improvements, also come with their own set of challenges, particularly when considered in the context of developing countries like Uganda.

2.4.1 Digital Rights Management (DRM) Systems

Digital Rights Management (DRM) systems represent one of the earliest and most widely adopted technological approaches to copyright protection in the digital age. These systems aim to restrict unauthorized access, copying, and distribution of digital content by embedding access control codes or usage rules directly within media files (Lessig, 2004). DRM can manifest in various forms, such as encryption, watermarking, or license management that dictates how many times a file can be played, on which devices, or for how long. For example, many e-books, streaming services, and software applications utilize DRM to control user access and prevent illicit sharing. However, the effectiveness and user acceptance of DRM are well-documented with significant limitations such as Bypassability: DRM systems are frequently criticized for being

susceptible to circumvention by tech-savvy infringers (Inkrypt Videos, 2024). Once a DRM scheme is "cracked," the content can be freely copied and distributed, negating its protective purpose, Inconvenience to Legitimate Users: A major drawback of DRM is its potential to inconvenience legitimate, paying users (Inkrypt Videos, 2024). Strict DRM can impose frustrating restrictions, such as device incompatibility, lack of offline access, performance slowdowns due to constant online verification, and platform lock-in, leading to a negative user experience (Inkrypt Videos, 2024). This often leads to consumer backlash and can even drive legitimate users towards pirated content as a means to escape these restrictions, Digital Obsolescence: DRM-protected content risks becoming unusable if the DRM servers shut down or if the underlying technology becomes obsolete, posing significant challenges for digital preservation and long-term access (Inkrypt Videos, 2024), Limited Impact in Developing Contexts: In environments like Uganda, where digital literacy might vary, and access to stable internet connectivity for constant verification can be an issue, DRM systems can further complicate legitimate content consumption and adoption, potentially pushing users towards simpler, albeit illegal, alternatives. This exposes a research gap in developing DRM solutions that are robust against circumvention, user-friendly, and culturally appropriate for regions with diverse technological infrastructures and consumer behaviors.

2.4.2 Automated Content Recognition (ACR) Technologies

Automated Content Recognition (ACR) technologies represent a more proactive modern approach, leveraging sophisticated algorithms to identify and, in some cases, automatically remove infringing content. Platforms like YouTube's Content ID system are prime examples, which utilize digital fingerprinting to detect copyrighted music or video segments within user-uploaded content (Kumar et al., 2020; WIPO, n.d. - "The Global Digital Music Landscape"). When a match is found, the copyright holder can choose to block the content, monetize it, or track its usage. ACR technologies are increasingly being adopted for broadcast monitoring, advertising verification, and managing intellectual property rights across various digital channels (Polaris Market Research, 2025).

Despite their power and growing sophistication, ACR technologies face their own set of challenges such as Subtle Alterations and Disguises: While powerful, these systems can struggle with content that has been subtly altered, remixed, or disguised to avoid detection (EUIPO, n.d. - "Automated Content Recognition: Existing technologies and their impact on IP"). This requires constant updates and refinement of the algorithms, Database Dependency: Their effectiveness is heavily dependent on the comprehensiveness and accuracy of their underlying databases of copyrighted works. If a work is not registered or fingerprinted in the system, it cannot be detected, Proprietary Nature and Accessibility for Independent Creators: Many of the most effective ACR systems tend to be proprietary to large platforms (e.g., YouTube's Content ID is an internal system). This limits their universal application and often restricts independent creators, who may not have access to these sophisticated tools or the resources to monitor usage across myriad platforms effectively (Audible Magic, n.d.), False Positives/Negatives: ACR systems can occasionally produce false positives (flagging legitimate content as infringing) or false negatives (missing infringing content), leading to disputes and delays in content management. This indicates a research gap in developing accessible, affordable, and universally applicable ACR solutions, particularly for independent artists and small content creators in developing economies, who often lack the resources to leverage these advanced, often platform-specific, tools.

2.4.3 The Emergence of Blockchain Technology

Amidst these established and evolving modern approaches, blockchain technology has emerged as a particularly promising and disruptive solution for copyright protection. It offers a decentralized, immutable ledger that can securely track ownership and transactions of digital assets (Tapscott & Tapscott, 2016). By recording intellectual property metadata and transactions on a distributed, tamper-proof network, blockchain technology provides a transparent and verifiable record of creation, ownership, and licensing. This capability directly addresses many of the shortcomings of both traditional and earlier modern methods, offering a more resilient, transparent, and equitable approach to digital copyright protection. Its potential lies in offering an unalterable timestamp of creation, transparent royalty distribution, and decentralized enforcement

capabilities, making it a compelling area for further exploration in combating copyright theft, especially within contexts like Uganda where existing systems face significant limitations.

2.5 Blockchain Technology and Copyright Protection

Blockchain technology is rapidly transforming the paradigm of copyright protection by leveraging its inherent features of immutability, transparency, and decentralization. Fundamentally, a blockchain functions as a distributed digital ledger where every transaction in this context, the registration or transfer of intellectual property is recorded in a secure, cryptographically linked chain of blocks. This architectural design ensures that once information is added to the blockchain, it cannot be altered or removed, thereby creating an exceptionally reliable and transparent record of ownership and activity (Nakamoto, 2008; Tapscott & Tapscott, 2016).

2.5.1 General Principles and Applications for Copyright

Blockchain technology, a decentralized and distributed digital ledger, has proven its transformative power across various sectors by securely recording transactions in a trustless environment. Beyond its origins in cryptocurrency, it has been successfully applied in supply chain management to create transparent and tamper-proof records of a product's journey, enhancing authenticity and consumer trust. In the healthcare sector, it has been leveraged to secure patient data and streamline the sharing of medical records. This versatility in managing assets, records, and transactions across different domains provides a strong foundation for its potential application in the creative industries, offering a robust solution to address long-standing issues in copyright management.

2.5.2 Core Principles and Their Application to Copyright in Uganda

The fundamental properties of blockchain technology are particularly well-suited to address persistent issues in copyright management within the Ugandan context. First, its immutability ensures that once a record is added to the blockchain, it is virtually impossible to alter or delete.

This allows creators to establish an unalterable, timestamped record of creation and ownership, providing indisputable proof of prior art and provenance crucial for copyright disputes. For Ugandan musicians, this means registering a song's unique digital fingerprint (hash) on a blockchain would create an immutable timestamp, proving the exact time of creation. This directly tackles the common challenge of proving ownership, especially for independent artists who may face issues with delayed or lost documentation from formal registration bodies like the URSB.

Furthermore, the transparency inherent in a public blockchain, where all validated transactions are visible to network participants, significantly complicates unauthorized use. While the large media files themselves would not be stored on the blockchain, their unique identifiers (hashes) and associated metadata (creator, date, licensing terms) would be. This transparency allows artists, industry bodies, or the URSB to verify ownership and track a work's lifecycle with greater ease, thereby exposing illicit activities that are rampant in Uganda's music scene due to informal distribution and uncredited usage.

The decentralized nature of blockchain, which distributes data across a network of computers rather than a single central database, makes it highly resilient to censorship, manipulation, and data loss. This decentralization could offer a more robust and accessible alternative for rights management for Ugandan artists, reducing their reliance on centralized bodies that can be slow or resource-constrained, especially for those in remote areas.

Finally, the integration of smart contracts self-executing agreements written directly into code on the blockchain can automate royalty payments and licensing agreements. This automation ensures that creators receive fair and immediate compensation for their work, streamlining a process that is traditionally opaque and plagued by delays and intermediaries. In the Ugandan music industry, where artists frequently complain about a lack of transparency and timely payments from collective management organizations (CMOs) or distributors, smart contracts could revolutionize revenue collection and distribution. A smart contract could automatically disburse royalties to all rights holders each time a song is streamed or played, based on pre-agreed percentages, providing unprecedented efficiency and bypassing exploitative intermediaries.

2.5.3 Potential Benefits for the Ugandan Creative Economy

Applying blockchain technology to Uganda's copyright challenges offers significant promise. It provides enhanced proof of ownership by creating irrefutable evidence of creation date and authorship, which is a major point of contention for many artists. The use of smart contracts for transparent royalty distribution can eliminate the "black box" of revenue collection, ensuring artists receive their fair share of revenue directly and promptly. This aligns with recent efforts toward a Copyright Management System in Uganda but offers a more decentralized and immutable foundation. Additionally, blockchain platforms can facilitate direct, peer-to-peer licensing between creators and users, reducing the need for intermediaries who often take substantial cuts, thus increasing the revenue share for artists. The system also offers a globally accessible platform, potentially opening up new international revenue streams for Ugandan artists that were previously difficult to tap into due to enforcement and tracking challenges.

2.5.4 Challenges and Research Gaps in Implementation

Despite its compelling advantages, implementing blockchain for copyright protection in Uganda is not without challenges. One key issue is scalability. Storing large media files directly on a blockchain is currently impractical due to storage costs and network congestion. While solutions like InterPlanetary File System (IPFS) can store the content off-chain with a blockchain record of its hash, managing the vast volume of digital content from a rapidly growing music industry presents significant scalability concerns. This highlights a research gap in designing efficient hybrid blockchain solutions that can handle such volume without compromising network performance.

Another major challenge is widespread adoption and user experience. Many Ugandan artists and consumers may lack the digital literacy or access to the necessary infrastructure, such as a stable internet and cryptocurrency wallets, to interact with a blockchain-based system. This necessitates research into developing user-friendly blockchain interfaces tailored for the Ugandan context, ensuring equitable access for all.

Furthermore, integrating a new system with existing legal and institutional frameworks is crucial. Uganda's legal framework for intellectual property and digital assets is still evolving, and specific regulations for blockchain-based copyright management are nascent. This points to a significant legal and policy research gap: how can Uganda's Copyright and Neighbouring Rights Act of 2006 be amended to recognize and enforce blockchain-based ownership and smart contracts effectively? The initial costs and infrastructure required to develop and maintain a robust blockchain system also pose a practical challenge given limited public sector resources, suggesting a need for research into sustainable funding models. Finally, interoperability is a technical challenge, requiring the development of standards that enable seamless cross-platform compatibility between different blockchain platforms and existing digital music services.

2.6 Theoretical Framework

This study is underpinned by a robust set of security-centered theoretical frameworks that collectively emphasize the paramount importance of protection, enforcement, and transparency for digital content rights within decentralized systems. These frameworks provide the conceptual lens through which the feasibility and design of a blockchain-based copyright protection system for Uganda's creative economy will be evaluated.

2.6.1 The CIA Triad: Foundational Security Principles

At its core, the study leverages the CIA Triad—Confidentiality, Integrity, and Availability—as a foundational model for evaluating how blockchain technology can effectively secure copyright data (Splunk, 2024; Check Point Software, n.d.). This triad represents the three primary goals of information security, ensuring data remains protected, accurate, and accessible:

Confidentiality: Ensures that only authorized individuals can access or utilize creative works. In a blockchain context, while transaction data (like hashes of works) are public, the content itself can remain confidential, and access to the full content is controlled through cryptographic keys and permissions. For Ugandan musicians, this means ensuring that their unreleased demos or master recordings are not leaked or accessed without their explicit permission, even if the record of their creation is on the blockchain.

Integrity: Guarantees that content, once recorded and attributed on the blockchain, cannot be modified, tampered with, or forged without detection. The cryptographic hashing and chaining of blocks inherent to blockchain technology directly address this by making any unauthorized alteration immediately detectable (Nakamoto, 2008). This is crucial for protecting the authenticity of an artist's original work and preventing unauthorized edits or misattribution, a significant concern for Ugandan creators whose works are often pirated and altered.

Availability: Ensures that copyright records and associated licensing terms remain reliably accessible to musicians, producers, and other relevant stakeholders whenever needed. The decentralized nature of blockchain, with multiple distributed copies of the ledger, inherently enhances availability, mitigating risks associated with single points of failure common in centralized systems (Zohar, 2015). For the Ugandan context, where internet connectivity can be intermittent and access to centralized services might be unreliable, a decentralized and resilient system enhances the continuous availability of critical copyright information.

Fig 2.1: A figure of the three aspects of the CIA triad as used in the blockchain framework.

The CIA Triad provides a comprehensive security lens for assessing the proposed blockchain solution, ensuring that fundamental security requirements are met in protecting the intellectual property of Ugandan artists.

2.6.2 Digital Rights Management (DRM) Aligned Frameworks

To robustly secure rights ownership and facilitate automated transaction management, the study incorporates models derived from established Digital Rights Management (DRM) frameworks. While traditional DRM has faced criticism (as discussed in Section 2.4.1), the underlying principles of defining and enforcing usage rules remain essential. This study aims to enhance these principles through blockchain's capabilities.

Trusted Computing Framework (TCF): The study draws from principles analogous to the Trusted Computing Framework (TCF), which aims to ensure that systems handling digital content operate in predictable and secure ways. While TCF often involves hardware-based security, its core concept of cryptographic protection to enforce policy compliance and verify system integrity (e.g., ensuring a licensed media player has not been tampered with) aligns synergistically with blockchain’s tamper-proof and immutable structure (MDPI, 2025, on using trusted computing in blockchain data transactions). In a blockchain context for copyright, this could imply that smart contracts verify the integrity of the usage environment or the identity of the user before granting access, creating secure environments where creative works are protected from unauthorized use and ensuring the integrity of their intellectual property. For Uganda, where untrusted third-party distribution often leads to rights violations, ensuring a trusted computing environment for digital content consumption is paramount.

Open Digital Rights Language (ODRL) Framework: The Open Digital Rights Language (ODRL) framework, developed by the World Wide Web Consortium (W3C), is integrated into the theoretical approach. ODRL provides a standardized, machine-readable language for formally defining and enforcing permissions, prohibitions, and obligations related to digital assets (W3C, n.d. - "ODRL Information Model 2.2"; W3C, n.d. - "ODRL V2.2 Implementation Best Practices"). By integrating ODRL specifications into smart contracts, the proposed system

enables transparent, automated enforcement of licensing terms, royalty distribution, and usage restrictions. This empowers creators to maintain granular control over how their content is accessed, used, and monetized across various platforms, reducing reliance on intermediaries and manual processes. For Ugandan musicians, this means that a smart contract could precisely define:

- Permissions: "Allow play in Uganda for X price."
- Prohibitions: "Do not allow unauthorized reproduction outside of licensed streaming platforms."
- Obligations: "Automatically pay Y% royalty to the songwriter when played on Z radio station." This level of granular, automated control, encoded in a machine-readable format, directly addresses the current opacity and inefficiency in royalty collection and distribution that plagues the Ugandan music industry, as highlighted by artists' complaints (Monitor, 2021).

2.6.3 Advanced Cryptographic Tools for Trust and Privacy

The theoretical framework further incorporates advanced cryptographic tools that complement the decentralized nature of blockchain by ensuring trust, authenticity, and data confidentiality without necessarily exposing all sensitive creator information to the public ledger.

Public Key Infrastructure (PKI): Public Key Infrastructure (PKI) is fundamental for verifying identity and securing digital signatures within the blockchain environment (Freeman Law, n.d.; SecuX Hardware Wallet, n.d.). PKI ensures the authenticity of participants (e.g., the creator asserting ownership, a licensee entering an agreement) and the integrity of records by associating cryptographic keys with verified identities. In a blockchain context, this means that every digital signature associated with a copyright registration or a licensing agreement can be cryptographically verified, ensuring that transactions originate from legitimate, identified parties. For Uganda, where identity verification and traceability in transactions can be challenging, PKI within a blockchain solution would provide a strong backbone for establishing trust and non-repudiation for creators and users alike.

Zero-Knowledge Proofs (ZKP): Zero-Knowledge Proofs (ZKP) are integrated to enhance privacy in transaction validation within the blockchain environment (Fujitsu, 2024; Dock Labs, 2025). ZKP allows one party to prove to another that they possess certain information or that a statement is true, without revealing the underlying sensitive data itself. For example, a creator could use ZKP to prove they hold the copyright to a work without exposing their full identity or sensitive financial details on a public ledger. Similarly, a licensee could prove compliance with usage terms (e.g., "I have paid for this license" or "I am authorized to play this in this region") without revealing confidential business data. This feature is particularly valuable in addressing privacy concerns that arise with transparent public ledgers and would encourage broader adoption in Uganda by protecting sensitive commercial information while still enabling verifiable transactions.

2.7 Security Architectural Frameworks for Blockchain in Copyright Protection

The ultimate efficacy of blockchain technology in safeguarding copyrights is heavily contingent upon its judicious integration with established security architectural frameworks. These frameworks provide structured methodologies for ensuring comprehensive data integrity, maintaining confidentiality, and building resilience against evolving cyber threats—all of which are critical requirements for any robust copyright protection system. This section elaborates on key frameworks and their relevance to a blockchain-based solution for Uganda.

2.7.1 NIST Cybersecurity Framework (CSF)

Among the most influential models in this domain is the NIST Cybersecurity Framework (NIST CSF) (NIST, 2021). This framework delineates five core functions: Identify, Protect, Detect, Respond, and Recover, each of which aligns closely with blockchain’s inherent capabilities in intellectual property (IP) management (Putz et al., 2021).

Identify Function (Asset Management): This function emphasizes understanding and managing cybersecurity risks to systems, assets, data, and capabilities. In a blockchain context, the Identify function finds direct application through the immutable registration of creative works via

cryptographic hashing. For instance, platforms like Po.et have leveraged blockchain to timestamp and hash digital content, creating an unforgeable proof of ownership and existence (Wong & Lie, 2019; Bitget, n.d.). For Ugandan musicians, this means a reliable, decentralized way to establish the creation date and authorship of their songs, which is a foundational step currently lacking widespread, accessible, and verifiable methods (Asekenye, 2019). The blockchain serves as an undeniable public record of who created what and when, directly addressing the difficulty artists face in proving original ownership against widespread infringement.

Protect Function (Access Control & Data Security): This function focuses on developing and implementing appropriate safeguards to ensure the delivery of critical infrastructure services. Within a blockchain-based copyright system, the Protect function is primarily realized through the implementation of smart contracts, which can automate access control mechanisms and licensing agreements. Permissioned blockchain networks, such as those based on Ethereum's architecture (Buterin, 2014) or Hyperledger Fabric (Androulaki et al., 2018), can implement robust, role-based permission systems that restrict content usage to authorized parties, thereby mitigating unauthorized redistribution. For example, a smart contract could be programmed to release a music track for streaming only after a specific payment is received, or to grant broadcasting rights only to licensed radio stations, which can be verified on the blockchain. This moves beyond traditional DRM's limitations by embedding the rules directly into the decentralized code, significantly enhancing protection against unauthorized use, a persistent challenge in Uganda (Monitor, 2021).

Detect Function (Anomalies & Events): This function emphasizes developing and implementing appropriate activities to identify the occurrence of a cybersecurity event. Detection mechanisms within blockchain-based copyright systems often employ hybrid approaches. For example, services like Audible Magic integrate audio fingerprinting technologies with blockchain ledgers to monitor and flag unauthorized distributions in real time (Audible Magic, n.d.; Mulligan & Burstein, 2005). The blockchain can record the "fingerprint" or hash of legitimate content, and then external ACR systems continuously scan online platforms. If a match is found that violates pre-defined smart contract terms (e.g., unauthorized usage in a specific territory or without a license), an alert can be triggered on the blockchain. This provides a more efficient and

transparent detection capability compared to current manual or ad-hoc monitoring efforts in Uganda.

Respond and Recover Functions (Incident Response & Resilience): These functions focus on developing and implementing appropriate activities to take action regarding a detected cybersecurity incident and to restore capabilities. Within a blockchain context, the Respond and Recover functions are significantly facilitated by blockchain's inherent transparency and the automation capabilities of smart contracts (Tapscott & Tapscott, 2016). For instance, upon detection of infringement, a smart contract could automatically initiate a pre-programmed response, such as issuing an automated takedown notice or flagging the infringing content for immediate review and action. Furthermore, automated compensation mechanisms could be built into smart contracts to allow for rapid remediation, features notably absent or highly inefficient in traditional DRM systems and current royalty collection processes in Uganda (Panaf, 2023). Blockchain's immutable ledger also provides a clear, unalterable audit trail for investigations and recovery processes following an incident.

2.7.2 Zero Trust Architecture (ZTA)

Another pivotal framework applicable to this study is Zero Trust Architecture (ZTA), which operates on the fundamental principle of "never trust, always verify" (Rose et al., 2020; StrongDM, 2025). In decentralized copyright systems, ZTA is crucial for mitigating risks posed by malicious nodes or potential insider threats, which are particularly relevant in environments where trust in intermediaries is low.

Continuous Verification: ZTA assumes that no user, device, or application, whether inside or outside the network, can be implicitly trusted. Every access request to copyrighted content or its associated data on the blockchain must be continuously authenticated, authorized, and validated.

Least Privilege Access: ZTA enforces the principle of least privilege, meaning users and applications are granted only the minimum access necessary to perform their specific tasks. For instance, in a Hyperledger Fabric network – a permissioned blockchain suitable for enterprise use cases – the channel system can isolate sensitive copyright data, permitting access only to vetted

and authorized participants with specific roles (Androulaki et al., 2018; AST Consulting, 2023). This means a music producer might have access to production metadata, while a licensing agent only sees licensing terms, and a public user only sees ownership information. Such architectures are particularly relevant in the context of Uganda's creative economy, where issues of weak enforcement, opaque royalty distribution, and a lack of accountability have historically persisted (URSB, 2021; Panaf, 2023), leading to distrust among artists regarding their remuneration. ZTA helps build trust by programmatically ensuring that only authorized parties can interact with specific copyright data.

2.7.3 Challenges and Research Gaps in Framework Implementation

However, significant challenges remain in the widespread adoption and implementation of these security architectural frameworks in a blockchain context, particularly within Uganda:

Computational Overhead and Scalability: The computational overhead associated with certain cryptographic verification mechanisms, especially in Proof of Work (PoW) consensus systems, can significantly hinder scalability, particularly for high-volume content industries like music (Zohar, 2015; Debut Infotech, 2025). While alternative consensus mechanisms (e.g., Proof of Stake, Proof of Authority) offer better scalability, they might introduce other trade-offs in terms of decentralization or security. This highlights a crucial technical research gap: how can a blockchain-based system be designed to achieve optimal scalability for large volumes of music and audiovisual content transactions in Uganda without compromising the core security and decentralization benefits? This involves exploring specific layer-2 solutions or alternative blockchain architectures suitable for high throughput.

Legal Enforceability of Smart Contracts: The legal enforceability of smart contracts varies considerably across different jurisdictions, posing a challenge for global intellectual property rights management (Sengupta, 2025; ResearchGate, 2025). While a smart contract can automate execution, its legal standing in a Ugandan court, especially in complex dispute resolution, is still largely uncharted territory. This represents a significant legal research gap: what legislative reforms or legal interpretations are needed within Uganda to explicitly recognize and enforce blockchain-based smart contracts for copyright licensing and royalty distribution? This includes

addressing issues of contract formation, interpretation, and dispute resolution mechanisms for such novel agreements.

Interoperability: For a blockchain solution to be truly impactful, it needs to interoperate with existing digital platforms (e.g., streaming services, social media) and potentially with other national or international IP databases. Achieving seamless data exchange and rights enforcement across disparate systems presents a complex technical hurdle. This identifies a technical and standardization research gap: how can interoperability standards be developed and adopted to allow a Ugandan blockchain copyright system to effectively communicate with global digital content platforms and other relevant IP registries?

Cost of Implementation and Maintenance: Deploying and maintaining a robust blockchain-based system, especially one incorporating advanced security frameworks, requires significant initial investment and ongoing operational costs. For a developing economy like Uganda, securing sufficient funding and expertise for such an undertaking is a practical challenge. This points to a practical research gap: what sustainable business models and funding mechanisms can support the development, deployment, and long-term maintenance of a blockchain-based copyright solution tailored for the Ugandan creative economy?

2.8 Blockchain Integration in Copyright Systems: Lessons from Global and African Implementations

The practical application of blockchain technology in copyright protection has been demonstrated across diverse global and increasingly, African, industries. These implementations offer valuable empirical insights pertinent to Uganda's creative sector, highlighting both the promise and persistent challenges of this innovative technology.

2.8.1 Global Case Studies and Innovations

Early adopters of blockchain in copyright have provided foundational examples:

Spotify and MediaChain (2017): Spotify's acquisition of MediaChain highlighted blockchain's potential role in resolving complex music ownership disputes and ensuring fair attribution. MediaChain aimed to create a decentralized database of music rights metadata, linking it to a public ledger to ensure accurate royalty distribution to artists (Labs, 2017). This model subsequently influenced other platforms like SoundCloud for transparent licensing. This directly addresses the gap in transparent and accurate royalty distribution that plagues the music industry globally, including Uganda, where artists often express concerns about opaque payment systems from Collective Management Organizations (CMOs) (Panaf, 2023).

KodakOne (2018): This project exemplified how hybrid systems could enhance enforcement by combining blockchain with image recognition technology to detect unauthorized use of photographs (Kodak, 2018). It created an encrypted digital ledger to register rights, tracked images online, and enabled photographers to receive compensation for licensing or initiate infringement claims. This demonstrates the potential for combining blockchain's immutable record-keeping with powerful content detection technologies, a critical need for Uganda given the prevalence of digital piracy (Namara, 2021).

Blockai (now Binded): In the academic and independent creator sphere, Blockai pioneered blockchain-based copyright registration for digital artworks, significantly reducing reliance on centralized authorities and providing verifiable proof of creation (Boucher, 2016). This showcases blockchain's ability to empower individual creators with tools for self-registration and proof of intellectual property, circumventing the administrative hurdles and costs sometimes associated with traditional copyright offices, which can be a barrier for many emerging Ugandan artists.

These global case studies collectively reveal a common theme: blockchain's true value in intellectual property management lies not in its isolation, but rather in its strategic integration with complementary technologies. For example, the InterPlanetary File System (IPFS) has been widely utilized to mitigate blockchain's inherent storage limitations by offloading large media files (e.g., high-resolution audio or video) while retaining hash-based verification on the blockchain itself (Benet, 2014). This approach ensures content integrity and provenance without

excessively burdening the blockchain network, providing a scalable solution for managing vast amounts of digital creative content. This hybrid architecture directly addresses the technical scalability gap related to storing large media files on a blockchain.

2.8.2 African Perspectives and Implementations

The African continent, with its rapidly growing digital economy and vibrant creative industries, has also seen nascent but significant explorations of blockchain for copyright and IP management:

Nigeria: The Nigerian music industry, often lauded as "Nollywood of Music" for its global reach, faces immense challenges with piracy and opaque royalty structures (Awka Journal of Research in Music and the Arts, 2024). Researchers and industry players in Nigeria have actively proposed blockchain as a veritable tool for combating music piracy (Awka Journal of Research in Music and the Arts, 2024; Dev Technosys, 2025). The focus is particularly on leveraging blockchain to:

- Eliminate intermediaries: By enabling direct artist-to-fan sales, cutting down on fees from distributors and marketers who often take a significant cut, thus increasing artists' earnings (Awka Journal of Research in Music and the Arts, 2024). This directly resonates with the struggles of Ugandan artists with revenue recovery.
- Establish origins and eliminate pirated copies: Through tokenization (e.g., NFTs) and immutable records, blockchain can assign unique, verifiable codes to songs, making intellectual theft and wrongful ownership claims extremely difficult (Awka Journal of Research in Music and the Arts, 2024; Dev Technosys, 2025). This addresses the pervasive issue of proving ownership and combating the ease of digital replication in both Nigeria and Uganda.
- Automate royalties: Blockchain-based platforms, often utilizing smart contracts, are seen as a solution to the "difficult and sometimes ambiguous structure" of royalty payments, ensuring artists are paid equitably and transparently (Dev

Technosys, 2025). This directly parallels the concerns of Ugandan artists regarding UPRS and other CMOs.

South Africa: While South Africa's blockchain adoption is often discussed in the context of finance and public sector governance, its creative industries are also exploring its potential for transparency and revenue generation. The convergence of blockchain, fintech, and digital entertainment is seen as empowering South African creators to earn more, engage fans, and attract investment (FurtherAfrica, 2025). Blockchain's transparency is identified as a "game-changer" for royalty payments and rights management, allowing for smart contracts to automatically pay various stakeholders (e.g., filmmakers paying actors, producers, crew) when content is streamed or sold (FurtherAfrica, 2025). This points to a shared African vision for fairer and faster revenue distribution that blockchain can facilitate, which is highly relevant to Uganda's creative sector.

Broader African Context: Across Africa, blockchain is being explored for diverse use cases beyond finance, including digitizing art and culture through Non-Fungible Tokens (NFTs) (Africa Tech Summit, 2024). Artists from Nigeria, Ethiopia, Ghana, South Africa, and Kenya are using NFTs to showcase culture, widen audience reach, and gain global recognition, blending heritage with cutting-edge technology (Africa Tech Summit, 2024). This signifies a growing regional acceptance and experimentation with blockchain's potential for creative monetization, providing valuable lessons for Uganda on the practicalities and benefits of digital asset creation and management.

2.8.3 Persistent Adoption Barriers and Global Challenges

Despite these promising implementations, significant adoption barriers persist globally and are particularly acute in African contexts:

Computational Overhead and Scalability: Certain blockchain consensus mechanisms, such as Proof of Work (PoW), while offering high security, incur substantial computational overhead and

energy consumption, hindering scalability, especially for high-volume content industries (Zohar, 2015). Even more energy-efficient mechanisms like Proof of Stake (PoS) require robust validator networks, which can present a considerable challenge for countries with limited technological infrastructure and unreliable power supply (King & Nadal, 2012; World Bank, 2023). This is a critical technical research gap for Uganda: identifying and validating low-cost, scalable consensus models that are suitable for the local infrastructure realities.

Interoperability: The issue of interoperability between disparate blockchain systems and legacy copyright databases (e.g., WIPO's global IP registry, or even Uganda's URSB database) remains largely underdeveloped (WIPO, 2021). This fragmentation hinders seamless data exchange and broader integration, preventing a unified global or even national system for copyright management. This identifies a significant technical and policy research gap: developing or adapting interoperability standards that allow a proposed Ugandan blockchain solution to communicate effectively with both local and international IP systems.

Legal Enforceability and Regulatory Clarity: The legal enforceability of smart contracts varies considerably across different jurisdictions (Sengupta, 2025). The lack of clear legal frameworks specifically addressing blockchain and smart contracts in many African countries, including Uganda, poses a challenge for global intellectual property rights management and dispute resolution. This highlights a crucial legal and regulatory research gap: how can the legal framework in Uganda be adapted to provide clear guidance and enforceability for blockchain-based copyright registrations, smart contracts, and associated intellectual property rights?

Digital Literacy and Access: While not strictly a security architectural framework issue, the widespread adoption of any blockchain solution in Uganda will be limited by the levels of digital literacy and access to reliable internet and compatible devices among creators and consumers (Uganda Bureau of Statistics, 2021).

2.8.4 Lessons for a Tailored Ugandan Framework

For Uganda, these global and African lessons underscore the critical necessity of developing a blockchain framework that is specifically tailored to the country's unique socio-technical and economic landscape.

Prioritize Scalable and Low-Cost Consensus Models: The framework must prioritize the adoption of low-cost, energy-efficient, and scalable consensus models, such as Delegated Proof of Stake (DPoS) or Proof of Authority (PoA), to effectively address infrastructure limitations (e.g., uneven internet penetration, unreliable energy access) while maintaining network security (World Bank, 2023). Unlike energy-intensive Proof of Work systems, these alternatives minimize computational overhead, a crucial consideration for a developing economy. This forms a key design consideration for the proposed solution to address the efficiency and accessibility gaps.

Embrace Hybrid On/Off-Chain Storage Architectures: Hybrid on/off-chain storage architectures should be a core component to efficiently manage large creative works (e.g., high-resolution music or film files) without overburdening the blockchain itself. Solutions like IPFS can store the content off-chain while anchoring cryptographic proofs (hashes) on-chain, ensuring verifiability and provenance without compromising scalability (Benet, 2014). This directly addresses the technical challenge of storing large digital assets efficiently.

Foster Legal-Tech Collaboration and Regulatory Alignment: The framework must actively foster legal-tech collaboration to ensure that automated functionalities, such as smart contracts, align seamlessly with Uganda's Copyright and Neighbouring Rights Act (2006). For instance, automated royalty distributions via smart contracts could be designed to comply with Uganda's existing royalty collection mechanisms, such as those managed by the Uganda Performing Rights Society (UPRS), while simultaneously addressing identified enforcement gaps and promoting greater transparency (URSB, 2021; Panaf, 2023). This requires proactive engagement with regulatory bodies and legal experts to develop a compliant and enforceable system. This points to a significant implementation gap requiring inter-sectoral collaboration and policy innovation.

2.8.5 Proposed Framework: A Blockchain-Based Solution for Uganda's Music Industry

In response to the persistent and multifaceted challenges of copyright infringement and revenue loss in Uganda's creative industry, this study developed and proposes a comprehensive blockchain-based framework specifically tailored to the music sector. The framework was designed to enhance copyright protection, facilitate automatic royalty distribution, and promote transparency through a decentralized, tamper-proof digital system. By integrating blockchain technology into copyright management, the framework offers a novel approach to resolving enforcement and compensation issues that existing legal and technological systems have demonstrably struggled to address (Asekenye, 2019; Namara, 2021; Wasula, 2021). The subsequent subsections detail the core components of this proposed framework.

2.8.6 Core Components of the Framework

The proposed blockchain-based framework comprises several interconnected components, each engineered to address a specific challenge within Uganda's creative economy:

Protection Registrar: This foundational layer serves as a digital platform where creators can register their musical works. Upon successful registration, each work is assigned a unique cryptographic hash, which is then immutably recorded on the blockchain. This hash functions as an unalterable, timestamped proof of ownership and existence (Tapscott & Tapscott, 2016). This component is crucial for preventing unauthorized claims and directly aligns with the objectives of the Uganda Registration Services Bureau (URSB, 2021) to formalize intellectual property registration. For Ugandan musicians, who frequently lack formal documentation or face difficulties in proving original authorship during disputes (Kaggwa, 2018), this provides an indisputable, decentralized record resistant to tampering or loss.

Copyright Metadata Registry: Complementing the Protection Registrar, this registry stores essential details about each copyrighted work. Information includes the creator's name, names of co-owners, comprehensive licensing terms, and precise ownership percentages for all contributing parties. This metadata is permanently linked to each registered work on the blockchain, enabling seamless and transparent verification of rights. This directly addresses the opacity prevalent in

current rights management, where artists often lack a clear understanding or verifiable records of their co-ownership and licensing agreements (Nile Post, 2025; Wasula, 2021).

Ownership Tracking Ledger: This critical component records all transfers of ownership and licensing agreements pertaining to a musical work. By documenting every transaction on the blockchain, it ensures a transparent and auditable trail of ownership from creation through all subsequent uses. This effectively eliminates disputes over rights attribution and provides unambiguous clarity on who holds which rights at any given time (Nabukenya & Mugisha, 2020). This is particularly vital in Uganda's informal music sector, where verbal agreements and the absence of formal contracts frequently lead to disputes and exploitation, as evidenced in local media reports on artist grievances (Monitor, 2021; Panaf, 2023).

Smart Contracts: A pivotal feature of the proposed framework is the integration of Smart Contracts self-executing digital agreements coded and stored directly on the blockchain. These contracts are designed to automatically distribute royalties to rights holders whenever the music is played, streamed, or licensed, based on predefined terms. This automation ensures efficiency, significantly reduces administrative overheads, and minimizes the need for multiple intermediaries who traditionally deduct substantial portions from artists' earnings (Christidis & Devetsikiotis, 2016; Awka Journal of Research in Music and the Arts, 2024). This directly tackles the long-standing issue of delayed, unfair, or uncollected payments frequently faced by Ugandan creators (Monitor, 2021; Panaf, 2023), thereby fostering greater trust and transparency in financial flows.

Royalty Distribution Engine: This engine operates in conjunction with smart contracts, processing real-time usage data (e.g., from streaming platforms, radio airplay, public performances) and allocating earnings based on the predefined ownership structure and licensing terms stored within the metadata and smart contracts. This mechanism is specifically designed to resolve the pervasive problem of delayed or unfair payments that many Ugandan creators currently experience, providing a more equitable and timely remuneration system, a challenge consistently highlighted by industry stakeholders (Wasula, 2021; Nile Post, 2025).

Usage Tracking and Auditing: The system incorporates robust Usage Tracking and Auditing

capabilities, which capture every instance of content usage. This includes tracking on digital platforms (e.g., streaming services, social media) and potentially in physical venues through integrated audio fingerprinting and logging tools. These usage logs, recorded on the immutable blockchain, are accessible to all relevant stakeholders, fostering accountability and significantly strengthening enforcement mechanisms against unauthorized use (Namara, 2021). This provides a verifiable audit trail that is largely absent in current Ugandan copyright enforcement efforts, where tracking usage across diverse platforms poses a major challenge for organizations like UPRS (Panaf, 2023).

2.8.7 Stakeholder Engagement and Opportunity Identification

Beyond core rights management, the framework integrates features aimed at empowering creators and fostering broader industry growth:

Stakeholder Access Portal: This portal provides creators, regulators (such as URSB), and collective management organizations (CMOs, like UPRS) with real-time insights into copyright status, earnings, and content usage. This enhanced transparency empowers creators to make informed decisions about their careers and intellectual property, while enabling oversight bodies to monitor compliance and identify infringement more effectively. This addresses the critical lack of accessible, real-time data that currently hinders effective management and enforcement within Uganda's creative sector (Kaggwa, 2018).

Opportunity Tracking: Leveraging data analytics derived from content usage, this component identifies high-performing content, analyzes audience engagement trends, and pinpoints potential monetization opportunities (e.g., new markets, licensing deals, sync placements). This feature supports creators in expanding their reach and income, moving beyond mere protection to active economic empowerment within the creative industry, aligning with broader goals for digital transformation in the creative sector across Africa (Africa Tech Summit, 2024).

2.8.8 Underlying Infrastructure and Integration Considerations

The entire framework is secured by an underlying blockchain infrastructure, which inherently offers cryptographic security, decentralization, and immutability (Nakamoto, 2008).

Permissioned Blockchain Model: A permissioned blockchain model, such as Hyperledger Fabric, was recommended for this framework. This strategic choice provides controlled access for verified users (e.g., creators, CMOs, legal entities, broadcasters) while maintaining data integrity and scalability (Androulaki et al., 2018; AST Consulting, 2023). Unlike public, permissionless blockchains, a permissioned network allows for the necessary level of governance and identity management required for a legal and commercial copyright system. This model also facilitates easier integration with Uganda's existing legal frameworks and copyright registration systems (Kaggwa, 2021; URSB, 2021), as it permits the inclusion of regulatory nodes and compliance mechanisms essential for operating within an established national IP ecosystem.

Hybrid On/Off-Chain Storage: To mitigate the scalability challenges associated with storing large media files directly on the blockchain, a hybrid on/off-chain storage architecture was envisioned. Large music and film files would be stored off-chain (e.g., on decentralized storage networks like IPFS), while their cryptographic hashes and essential metadata are securely anchored on the blockchain (Benet, 2014). This ensures content integrity and provenance without overburdening the blockchain network, providing a practical and scalable solution for managing the vast amounts of digital creative content generated in Uganda, a country experiencing rapidly increasing digital content creation (Uganda Communications Commission, 2023).

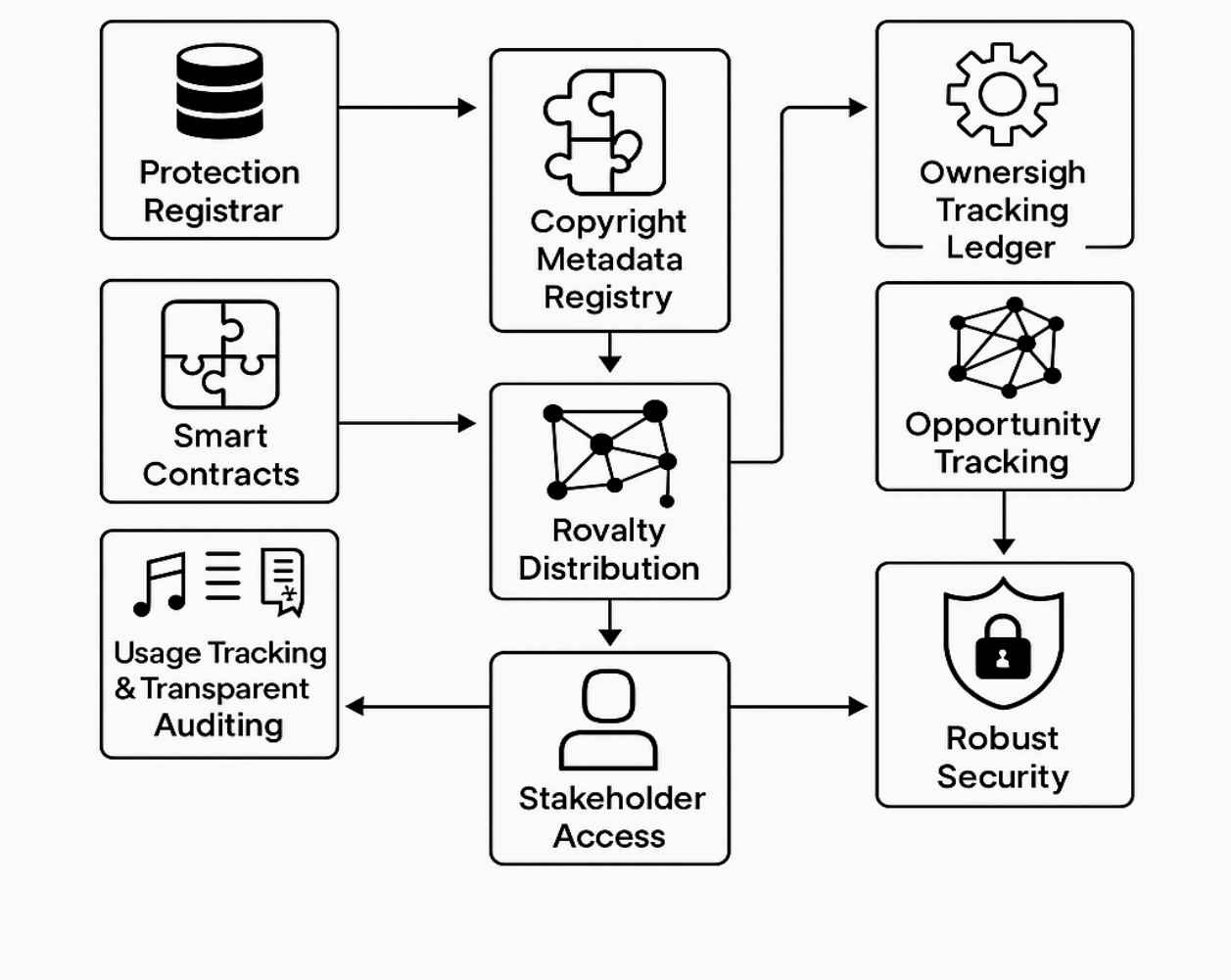

Figure 2.2: Conceptual framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Chapter overview

This chapter meticulously outlined the research methodology employed to address the study's objectives concerning copyright infringement and revenue loss in Uganda's music industry, and the potential of a blockchain-based solution. It began by elucidating the adopted research paradigm and the specific research design that guided the inquiry. Subsequently, it details the data collection methods utilized, encompassing both primary and secondary sources, and explains the rationale behind the sampling strategies. The chapter then transitioned into describing the procedures for data analysis, ensuring transparency and rigor in processing the collected information. Finally, ethical considerations pertinent to the research are discussed, affirming the study's commitment to responsible research practices. This comprehensive methodological exposition layed the groundwork for understanding how the study's findings were derived and substantiates the validity and reliability of its conclusions.

3.1 Adopted Research Method

This study adopted a qualitative research paradigm, employing a case study research design to achieve its objectives. This approach was chosen for its inherent ability to provide an in-depth understanding of a complex contemporary phenomenon within its real-life context, particularly when the boundaries between phenomenon and context are not clearly evident (Yin, 2018). Given the nuanced and multifaceted nature of copyright infringement, revenue loss, and the innovative application of blockchain technology within a specific cultural and industrial setting, a qualitative case study allowed for an intensive exploration of the lived experiences, perceptions, and systemic challenges faced by musicians in Uganda.

Specifically, the Uganda National Musicians Federation (UNMF) was selected as the single, instrumental case for this study. The UNMF, as the leading umbrella body for Uganda's music industry, provided a rich and relevant context for investigating the core research questions. Focusing on this specific organization enabled the researcher to delve deeply into the operational realities, existing pain points, and stakeholder perspectives unique to this significant entity within the Ugandan creative sector. This in-depth focus on a specific case was instrumental in capturing the granular details necessary to derive comprehensive requirements and inform the design of a tailored blockchain-based framework, moving beyond superficial observations to uncover the

underlying dynamics of copyright protection and revenue management within a key industry stakeholder (Stake, 1995; Creswell & Poth, 2018).

3.2 Data Collection Methods

To effectively address the study's objectives, this research employed both primary and secondary data collection methods. This multi-method approach was chosen to ensure a comprehensive dataset that reflected both stakeholder experiences and institutional contexts, ultimately informing the feasibility and design of a blockchain-based copyright protection framework for Uganda's music industry.

3.2.1 Primary Data Collection

Primary data were gathered through two main avenues: semi-structured interviews and semi-structured questionnaires.

Semi-structured Interviews: Semi-structured interviews were utilized to obtain in-depth, qualitative insights into the nuanced experiences and perspectives of key industry stakeholders. This method was particularly suitable for an exploratory and qualitative study that sought to understand complex social phenomena in depth, allowing the researcher to guide conversations around key themes while affording respondents the freedom to elaborate on their views (Gill et al., 2008; Creswell & Poth, 2018). Interviews were administered to purposely selected participants actively involved in Uganda's music industry. The selection criteria were based on their direct relevance to the subject matter and their potential to provide rich, informed insights into copyright challenges and the potential of blockchain applications. The participants included:

- Musicians: To capture their lived experiences of copyright infringement, challenges in royalty collection, and their perceptions of existing protection mechanisms.
- Record Label Executives and Producers: To understand the business and technical aspects of copyright management, licensing, and distribution from an industry perspective.
- Copyright Officials: From bodies such as the Uganda Registration Services Bureau

(URSB) and the Uganda Performing Right Society (UPRS), to gain insights into the legal and administrative challenges of copyright enforcement.

- Legal Professionals: Specializing in intellectual property law, to provide expert opinions on the legal framework and its limitations.
- Technology Innovators: With experience in blockchain applications, to discuss the technical feasibility and implementation challenges within the local context. Interview guides were developed and pre-tested to ensure consistency across interviews while maintaining the necessary flexibility to probe deeper into emerging themes and unexpected insights.

Semi-structured Questionnaires: In addition to interviews, the study employed semi-structured questionnaires to complement the qualitative data, enabling the collection of broader perspectives across a larger group of stakeholders. This method was justified as it allowed for the collection of both structured (quantitative) data that supported trend identification and open-ended (qualitative) responses for richer detail and nuanced insights (Creswell, 2014). The questionnaires were designed to capture stakeholders' perceptions of blockchain technology, their awareness and understanding of existing copyright laws, and the specific challenges encountered with current enforcement mechanisms.

Questionnaire administration

A significant portion of these questionnaires was administered digitally via a Google Form. This approach facilitated efficient data collection from geographically dispersed musicians and other stakeholders across Uganda, ensuring broader reach and convenience for participants (as reflected in the uploaded "Musicians' Perspectives on Copyright Protection and Revenue Loss in Uganda's Creative Industry- A study by Mr. Kasole Ahmed-BscIT ,UGANDA CHRISTIAN UNIVERSITY (Responses) - Form Responses 1.csv"). Physical copies of the questionnaire were also distributed in some instances to accommodate participants with limited digital access or preference for paper-based responses. The collected data from these questionnaires provided valuable insights into the scale of awareness, challenges, and general attitudes towards copyright and technological solutions within the Ugandan music community.

3.2.2 Secondary Data Collection

Secondary data were collected through comprehensive document analysis, which was essential for understanding the existing legal, regulatory, and industrial landscape relevant to copyright protection in Uganda. This method was crucial for triangulating primary data findings and strengthening the overall validity and reliability of the study (Bowen, 2009). The document analysis involved systematically reviewing:

Legal and Policy Documents: This included Uganda's Copyright and Neighbouring Rights Act (2006), any proposed amendments to intellectual property laws, relevant court cases on copyright disputes to understand judicial interpretations, and national policy documents related to creative industries development and technology integration (e.g., national ICT policies that might touch upon blockchain).

Academic Literature: Scholarly articles from academic journals, theses, and dissertations (including those from Ugandan universities) were consulted to provide theoretical and contextual depth on blockchain, intellectual property rights, digital transformation in creative industries, and copyright challenges in developing countries.

Industry Reports and Blockchain Whitepapers: Reports published by local and international music industry bodies, collective management organizations, and technology research firms were reviewed. Key blockchain whitepapers provided foundational technical understanding and insights into various blockchain implementations relevant to intellectual property.

Through this multi-method approach, the study was able to gather a comprehensive dataset that accurately reflected both the lived experiences of individual stakeholders and the broader institutional and legal contexts within which Uganda's music industry operates. This holistic data collection strategy was pivotal in informing the feasibility assessment and the detailed design of the proposed blockchain-based copyright protection framework.

3.3 Data Analysis

The data collected through the various primary and secondary methods underwent a rigorous

analysis process, tailored to the qualitative nature of the study. This section details the specific analytical approaches employed to derive meaningful insights from the collected dataset.

3.4.1 Qualitative Analysis

The qualitative data, derived from semi-structured interviews and the open-ended sections of the questionnaires, as well as the documentary analysis, were primarily analyzed using thematic analysis. This method, as articulated by Braun and Clarke (2006), is a widely recognized and systematic approach for identifying, analyzing, and interpreting patterns or themes within qualitative data. This approach was particularly useful in understanding complex issues such as the intricacies of copyright enforcement in Uganda, the varying levels of stakeholder awareness regarding intellectual property rights, and their diverse perceptions of blockchain technology's potential for adoption.

Thematic analysis in this study meticulously followed Braun and Clarke's (2006) six-phase process, ensuring a comprehensive and robust interpretation of the data:

Familiarization with the Data: In this initial phase, the researchers immersed themselves in the data. This involved transcribing all recorded interviews verbatim, and meticulously reading and re-reading all interview transcripts, open-ended questionnaire responses, and relevant documents. This iterative reading process allowed for a deep understanding of the dataset's content, nuances, and overall breadth.

Generating Initial Codes: Following familiarization, the data were systematically coded. This involved labeling segments of text (phrases, sentences, paragraphs) that captured key ideas, concepts, recurring patterns, or relevant points. Coding was performed both deductively (informed by the study's objectives and existing literature on copyright and blockchain) and inductively (allowing new codes to emerge directly from the data).

Searching for Themes: Similar codes were then grouped together to form broader, overarching patterns of meaning or potential themes. This phase involved actively looking for connections and relationships between codes, noting significant topics or recurring discussions across different data sources.

Reviewing Themes: The identified themes were rigorously reviewed in two stages. First, themes were checked against the entire dataset to ensure they accurately represented the content and were internally consistent. Second, the themes were reviewed in relation to each other to ensure coherence, distinctiveness, and to identify any sub-themes or hierarchical relationships. Themes that were not well-supported by the data or too fragmented were refined, merged, or discarded.

Defining and Naming Themes: Once the themes were finalized, they were clearly defined and given concise, descriptive names. This involved articulating the essence of each theme, its boundaries, and what specific aspects of the data it captured. This precision ensured that each theme conveyed a clear and meaningful contribution to answering the research questions.

Producing the Report: In the final phase, the defined themes were presented in a coherent narrative form. This involved weaving together the analytical insights with illustrative quotes from respondents to provide context, depth, and empirical grounding to the findings. The narrative was structured to directly address the research objectives, highlighting key discoveries and their implications.

To enhance coding efficiency, facilitate theme visualization, and ensure traceability of codes back to their original data sources, qualitative analysis software such as NVivo was utilized. This software assisted in managing large volumes of textual data, enabling systematic coding, searching for patterns, and refining themes more effectively.

3.3.1.1 Thematic Analysis of Interview Data

The interview transcripts formed a crucial part of the qualitative dataset, providing rich, detailed, and personal perspectives. Thematic analysis applied to this data focused on uncovering in-depth experiences and perceptions of musicians, industry executives, legal professionals, and copyright officials. Key areas of analysis included: the specific mechanisms of copyright infringement encountered, the financial and emotional impact of revenue loss, the perceived shortcomings of existing legal and institutional frameworks, the level of awareness and understanding of copyright laws, and detailed opinions on the perceived benefits, challenges, and feasibility of adopting blockchain technology for copyright protection and royalty distribution in Uganda. This direct

interaction allowed for the exploration of nuanced views and contextual factors that influenced stakeholders' stances.

3.3.1.2 Thematic Analysis of Open-ended Questionnaire Responses

The qualitative data derived from the open-ended questions within the Google Form and other distributed questionnaires complemented the in-depth interview data by providing a broader range of perspectives and sentiments from a larger pool of stakeholders, particularly musicians and other creative practitioners. Thematic analysis here focused on identifying recurring patterns, common challenges, shared perceptions, and prominent suggestions regarding blockchain adoption from a wider cross-section of the industry. While less detailed than interview data, these responses offered valuable insights into the prevalence of certain issues and general attitudes across the industry.

3.3.1.3 Analysis Tools

The data collected during this study, particularly from interviews and open-ended questionnaire responses, underwent rigorous thematic analysis. To facilitate this, Google Sheets and Microsoft Excel were employed as primary organizational tools. Raw qualitative data was meticulously transcribed and then systematically categorized within these spreadsheets, allowing for efficient sorting, filtering, and initial pattern identification.

Furthermore, the analytical process was significantly enhanced through the integration of AI Gemini. This advanced AI tool was utilized to assist in several key aspects of thematic analysis. Gemini helped in identifying emerging themes and sub-themes from the categorized data by processing large volumes of text and highlighting recurring concepts and sentiments. Its capabilities in natural language processing aided in refining the thematic coding, ensuring a comprehensive and nuanced understanding of the qualitative insights. Additionally, AI Gemini was instrumental in constructing the various graphs and visualizations presented in the analysis. By inputting the structured data from Google Sheets and Microsoft Excel, Gemini generated appropriate graphical representations, which effectively illustrated key findings and trends, thereby enhancing the clarity and impact of the study's results

3.4 Modeling and Testing

This study proposed a blockchain-based framework to combat copyright infringement and improve royalty distribution in Uganda's music industry. To rigorously evaluate its conceptual applicability and effectiveness in a practical context, the framework was modeled and conceptually tested using YouTube as a real-world simulation environment. YouTube was chosen not only because it is a dominant content-sharing platform globally but also because it is one of the most commonly used platforms in Uganda for publishing and distributing music content (Uganda Communications Commission, 2023). Unfortunately, YouTube also represents a significant hotspot for copyright violations, including unauthorized uploads and uncompensated usage, making it an ideal testbed for simulating blockchain-supported rights management scenarios (Digital Music News, 2023; MusiQ Note, 2024).

Given the nature of the challenges identified during the study—specifically unauthorized uploads, lack of proper attribution, and opaque royalty flows—the framework was designed to simulate how blockchain technology could enhance verification, ownership tracking, and automated royalty distribution for Ugandan artists using common YouTube scenarios. The modeling aimed to illustrate the practical benefits and operational mechanisms of the proposed system in addressing these prevalent issues.

3.4.1 Blockchain Types and Use Case Relevance

The conceptual testing environment leveraged a hybrid blockchain approach, combining features of both public and private/permissioned blockchains to optimize for transparency, security, and regulatory compliance. The rationale for selecting specific blockchain types for different functionalities during the testing phase is outlined below:

Feature Tested	**Type of Blockchain**	**Justification**

Copyright Registration	Public Blockchain (e.g., Ethereum, Bitcoin timestamping)	Public chains, characterized by their open access and decentralized nature, offer unparalleled transparency and immutability (Nakamoto, 2008; Tapscott & Tapscott, 2016). This makes them ideal for establishing universal, verifiable proof-of-ownership. By recording unique file hashes and timestamps on a public ledger, Ugandan artists could gain an indisputable, globally visible, and tamper-proof record of their creation, crucial for disputes. This addresses the prevalent issue of establishing undeniable prior ownership in a fragmented and often informal local industry where formal registration is not always practiced (Monitor, 2021; Wasula, 2021).
Ownership Tracking	Permissioned Blockchain (e.g., Hyperledger Fabric)	For sensitive operations like updating or tracing ownership data (e.g., after a collaborative work or rights transfer), role-based access control is paramount. A permissioned blockchain, such as Hyperledger Fabric, ensures that only verified users—like the original artist, co-creators, or authorized legal entities—can securely update or query ownership records (Androulaki et al., 2018; AST Consulting, 2023). This controlled environment maintains privacy while still providing an auditable trail, addressing concerns about data integrity and unauthorized manipulation of rights information crucial in multi-party collaborations and transfers common in Uganda's music industry.

Royalty Distribution	Public or Consortium Blockchain with Smart Contracts (e.g., Ethereum testnet, or Quorum)	The logic for royalty payments, once agreed upon, can be programmed and executed via self-executing smart contracts (Christidis & Devetsikiotis, 2016). These contracts would operate on either a public blockchain (for full transparency of transactions) or a consortium blockchain (for controlled participation among industry players). Payment flows could be simulated using event triggers such as YouTube views, plays, or licensing agreements. This automation directly tackles the longstanding problem of opaque, delayed, and often unequal payment systems within Uganda's music sector, ensuring fair and timely compensation for artists by disintermediating complex payment chains (Panaf, 2023; Awka Journal of Research in Music and the Arts, 2024).
Audit Logs & Usage Tracking	Permissioned Blockchain	Platforms like Hyperledger Fabric are well-suited for maintaining secure, private, and auditable transaction trails (Androulaki et al., 2018). Every instance of content usage, every royalty payout, and every access to data would be immutably logged on this permissioned chain. This functionality is vital for supporting regulatory compliance, facilitating internal audits, and providing an undeniable record for dispute resolution. It directly enhances transparency and accountability, countering the current lack of verifiable usage data and financial transparency that plagues royalty collection in Uganda (Namara, 2021).

Access Control	Permissioned Blockchain	Within the proposed framework, digital identities and certificates would be issued to various users, allowing for tiered access control to different parts of the system. For instance, registered artists would have access to their own data and royalty statements, while regulators (like URSB) or Collective Management Organizations (CMOs) would have broader oversight capabilities. This granular control minimizes the risk of unauthorized access or data manipulation, ensuring data security and privacy while allowing necessary transparency for relevant stakeholders within the Ugandan legal and regulatory landscape.
Legal Compliance Modeling	Permissioned Blockchain	The inherent flexibility and programmability of private networks allowed for the modeling and embedding of specific legal requirements. Key provisions from Uganda's Copyright & Neighbouring Rights Act (2006) were conceptually integrated within the chaincode logic (smart contract code). This approach ensures that the technical controls and automated functionalities of the blockchain framework are aligned with and reinforce national legal requirements, simplifying compliance and providing a pathway for legal enforceability of blockchain-based rights. This directly bridges the gap between technological innovation and existing legal frameworks in Uganda (Kaggwa, 2021).

3.4.2 How Testing Was Conducted Using YouTube

The conceptual testing relied on practical simulation of common, real-life copyright infringement scenarios frequently occurring on YouTube, especially pertinent to the Ugandan context. These scenarios were constructed using hypothetical but realistic metadata (e.g., simulated file hashes, timestamps, artist information, and usage metrics) and YouTube platform conditions to determine the blockchain framework's capacity to address the core issues identified during the study.

Examples of simulated scenarios included:

Unauthorized Re-upload: Simulating a scenario where an individual re-uploads an artist's original song without permission. The test aimed to demonstrate how the blockchain's Protection Registrar and Ownership Tracking Ledger would immediately identify the original ownership, and how smart contracts could potentially trigger an automated takedown request or flag the content for dispute resolution.

Lack of Attribution/Misattribution: Modeling cases where an artist's work is used, but proper credit or co-ownership splits are omitted or incorrectly represented. The simulation demonstrated how the Copyright Metadata Registry would provide immutable proof of correct attribution and how this data could be accessed and verified by all parties.

Delayed/Opaque Royalty Payments: Creating scenarios where a song generates significant YouTube views, but the corresponding royalty payments are either delayed, miscalculated, or not transparently accounted for. The Royalty Distribution Engine and Smart Contracts were simulated to illustrate automated, transparent, and timely distribution based on simulated view counts, with Audit Logs providing a clear, verifiable record of transactions.

Dispute Resolution: Simulating a dispute over ownership or licensing terms. The framework's ability to provide an immutable Ownership Tracking Ledger and Audit Logs was tested to show how it could expedite resolution by providing undeniable evidence.

The evaluation criteria for these simulations focused on the framework's ability to:

- Provide verifiable proof of ownership and origin.
- Automate royalty distribution efficiently and transparently.
- Maintain an immutable and auditable record of all transactions and usage.
- Ensure secure access control for different stakeholders.
- Align technical functionalities with Uganda's copyright legal framework.

CHAPTER FOUR

PRESENTATION OF THE STUDY FINDINGS

4.0 Chapter overview

This chapter presents the findings derived from the qualitative data collected through semi-structured interviews and open-ended questionnaire responses, complemented by insights from document analysis. It outlines the key results pertaining to copyright infringement challenges, current enforcement mechanisms, stakeholder perceptions of blockchain technology, and the proposed framework's design and conceptual validation. The data collected during this study were subjected to rigorous qualitative analysis, primarily through thematic analysis as detailed in Section 3.4.1.

4.2 Demographics of Participants and General Overview

The demographics of the study participants were a foundational component of the data collection process, providing essential context for the subsequent findings. This section presents a detailed overview of the participants, focusing on key variables that influence their experiences within the

creative sector. Specifically, data was gathered on the distribution of musicians by their geographic region and years of active professional experience, as well as by age and gender. These demographic insights, as detailed in Figure 4.1, are crucial for understanding the diversity of the participant pool and for interpreting the broader trends and challenges discussed in the study.

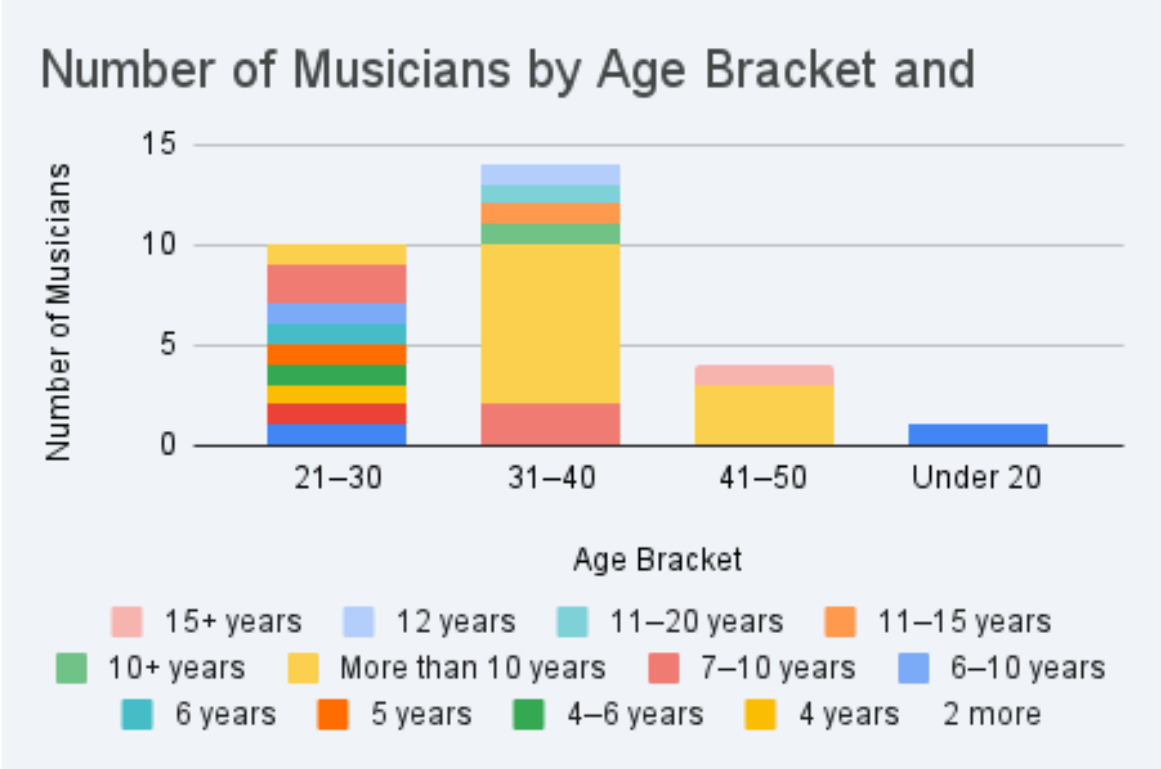

Figure 4.1: Participant demographics

4.3 Key Findings on Copyright Infringement and Current Structures

4.3.1 Prevalence and Forms of Copyright Infringement

The qualitative analysis revealed that copyright infringement is a rampant and multifaceted problem within Uganda's music industry, presenting a significant hurdle to musicians' economic

sustainability and creative control. This widespread issue manifests in several distinct forms, as detailed by the study's participants.

A primary and deeply damaging form of infringement is unauthorized distribution. Musicians frequently reported that their creative works are widely and freely shared on unregulated digital platforms, including unofficial websites, social media groups, and messaging applications, without their consent or any form of compensation. This digital piracy is further compounded by the persistent practice of physical piracy, where counterfeit CDs and DVDs are sold by street vendors with impunity. This pervasive unauthorized sharing not only deprives artists of their rightful income but also renders it nearly impossible to accurately track the true usage and popularity of their work, making it difficult to monetize their creative output effectively.

Another significant issue identified was the lack of attribution and, in some cases, outright impersonation. Participants frequently described situations where their musical compositions were used or adapted in new works without proper credit. More egregiously, some respondents highlighted instances where their original works were presented as the new creations of other parties, a practice that not only undermines their intellectual property rights but also erodes an artist's brand and makes it difficult for them to build a reputable and verifiable creative portfolio.

Furthermore, musicians cited persistent problems with performance rights violations. Their music is frequently played in public venues such as clubs, restaurants, and on radio stations without the proper licenses being secured or royalty payments being remitted through collective management organizations (CMOs) like the Uganda Performing Right Society (UPRS). This systemic failure in monitoring and enforcement results in a substantial loss of revenue that should be flowing back to the creators, highlighting a critical loophole in the current legal and enforcement mechanisms designed to protect artists' interests. A particularly poignant quotation from an emerging artist powerfully encapsulates the widespread frustration felt within the industry:

> *"We're told exposure is key, and we get plenty of that online, but you can't pay your bills with likes and shares."*

This statement from an upcoming artist under UMNF, underscores the stark reality that while

digital platforms may provide visibility, the existing frameworks are failing to translate that visibility into tangible financial compensation, which is a key driver of the industry's economic challenges.

4.3.2 Challenges in Current Copyright Enforcement and Royalty Collection

The study's participants highlighted a range of significant challenges with the existing copyright enforcement and royalty collection systems in Uganda, which collectively create a difficult environment for musicians to protect their intellectual property and earn a sustainable income. A key theme was the ineffectiveness of enforcement bodies, with a widespread perception that existing legal and institutional frameworks were largely inadequate for prosecuting infringers. This was attributed to factors such as slow judicial processes, limited resources for enforcement agencies, and a lack of public awareness, which fosters a culture of impunity. Furthermore, musicians expressed deep dissatisfaction with the opacity in royalty distribution, often receiving minimal or no payments from collective management organizations with little to no visibility into how their earnings were calculated. This "black box" approach has fostered a deep sense of mistrust and frustration within the artist community. Another significant barrier discussed was the high cost and complexity of legal recourse, as pursuing action against infringers was deemed prohibitively expensive and impractical for most artists, effectively denying them access to justice. Finally, a significant lack of awareness among both artists and the general public regarding copyright laws and their implications was identified as a contributing factor, perpetuating the cycle of infringement.

4.3.3 Musicians' Satisfaction with Current Copyright Structures

Musicians' satisfaction with the current copyright structures was overwhelmingly low, as directly captured by the questionnaires. The data indicated a strong and consistent consensus among

musicians that the existing systems were failing to adequately protect their intellectual property and ensure fair compensation. This dissatisfaction was a direct result of the systemic issues identified in the qualitative interviews, such as opaque royalty distribution, ineffective enforcement, and high costs of legal recourse. This sentiment underscores a profound disconnect between the purpose of the existing frameworks and their practical impact on artists' livelihoods.

A particularly telling finding from the survey data highlighted that a significant majority of musicians expressed a lack of trust in the institutions responsible for copyright management. This pervasive distrust is a symptom of a larger systemic failure.

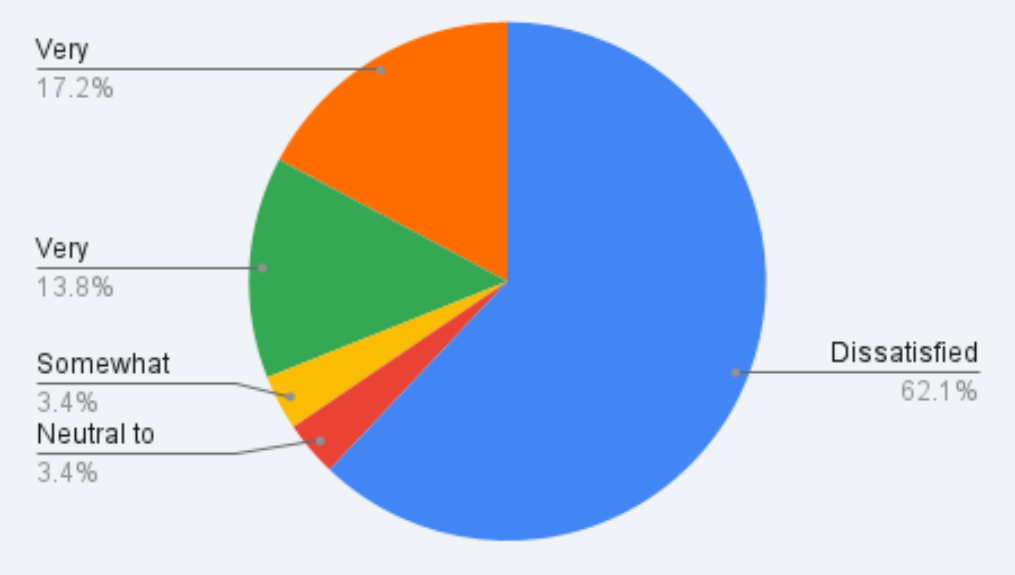

Fig 4.2 :Musician satisfaction with copyright protection structures in Uganda.

> *"We don't trust the system. You work hard on a song, and then you just hope someone honest gives you something back. Most times, they don't."*

This quote powerfully encapsulates the prevalent feeling of powerlessness and hopelessness. It reinforces the urgent and critical need for a transformative solution that can not only address the

functional deficiencies of the current system but also restore trust and transparency to the copyright ecosystem. The findings collectively underscore that a solution is not just desired, but essential for the economic and creative viability of Uganda's music industry.

4.4 Major Challenges Faced by Musicians in Earning Revenue

Beyond direct copyright infringement, the study identified broader challenges that hinder musicians' ability to earn sustainable revenue. These challenges, while distinct, are deeply linked to the efficacy of copyright protection and the overall business ecosystem. The analysis revealed that many artists struggle not only with piracy but also with a lack of transparency from intermediaries and a digital skills gap. One participant's comment highlights this interconnected problem, noting that they often feel a lack of control over their careers: "We spend so much time making the music and so little time getting paid for it. Everything is handled by someone else, and you're just told to wait." This sentiment underscores a systemic issue where musicians are often at the mercy of opaque business practices and a fragmented value chain. The challenges in earning revenue, therefore, are not solely a consequence of piracy but are also rooted in a lack of robust mechanisms that empower artists with direct control over their intellectual property and financial flows.

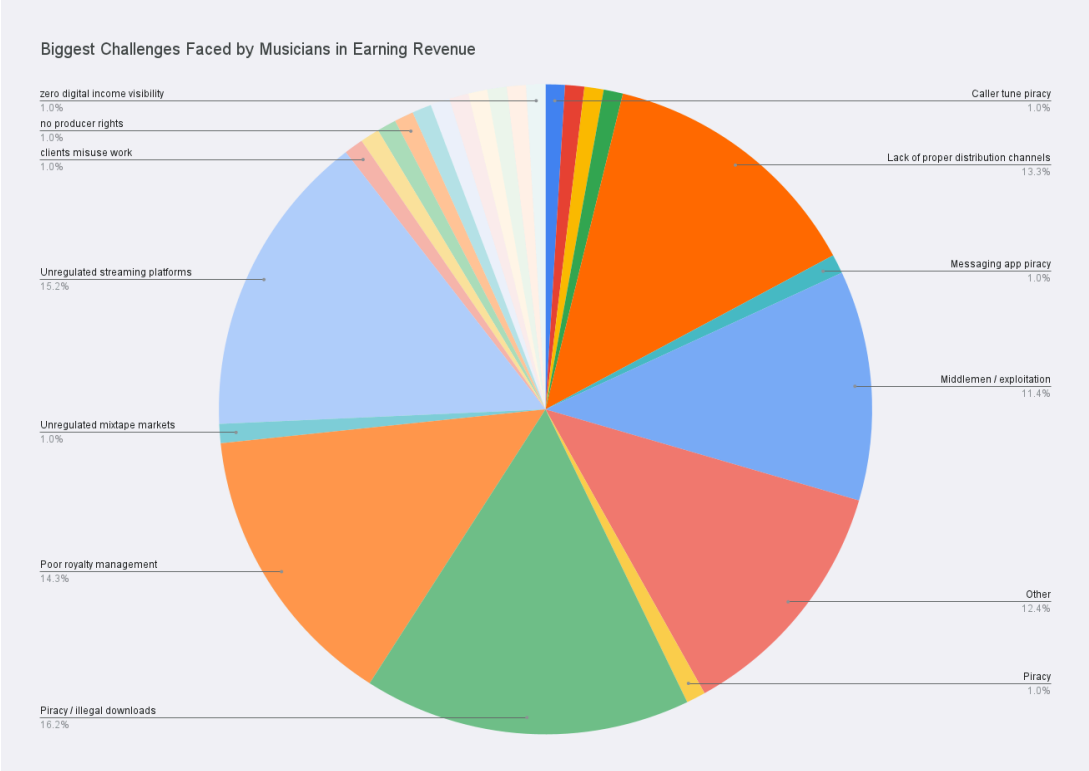

Fig4.3 :The Biggest Challenges Faced by Musicians in Earning Revenue

Table 4.1: Challenges Faced by Musicians in Earning Revenue

Challenge	***Count***
Caller tune piracy	*1*
Copy-paste culture	*1*

DJ rights ignored	*1*
Exploitative aggregators	*1*
Lack of proper distribution channels	*14*
Messaging app piracy	*1*
Middlemen / exploitation	*12*
Other	*13*
Piracy	*1*
Piracy / illegal downloads	*17*
Poor royalty management	*15*
Unregulated mixtape markets	*1*
Unregulated streaming platforms	*16*

clients misuse work	*1*
long registration process	*1*
no legal protection	*1*
no producer rights	*1*
no radio royalties	*1*
piracy	*1*
poor distribution	*1*
royalty mismanagement	*1*
unethical resellers	*1*
unregulated streaming	*1*
zero digital income visibility	*1*

These challenges included:

Poor Monetization of Digital Content: Despite widespread consumption of digital music, many artists struggled to effectively monetize their content due to poor infrastructure, low streaming rates, and pervasive piracy.

Lack of Effective Distribution Channels: Difficulties in reaching broader audiences and distributing music beyond immediate local networks.

Limited Access to Funding and Investment: A general scarcity of financial support for artists to produce and promote their work.

4.5 Perceptions of Blockchain Technology's Potential

The study explored stakeholders' awareness and perceptions of blockchain technology as a potential solution, and the findings were quite revealing. While many grassroots artists were still unfamiliar with the concept, those who knew about it expressed genuine optimism. It's a mix of hope for a better future and a healthy dose of skepticism about the practicalities of making it work.

One of the most exciting ideas for them was the potential for enhanced transparency. The thought of an unchangeable record of every transaction was seen as a real game-changer for how royalties are handled. This is a huge deal because there is a lot of mistrust between artists and the middlemen in the industry. As one legal expert so perfectly put it, blockchain's ability to make every transaction visible would fundamentally revolutionize trust in the creative sector. This statement gets right to the heart of it: transparency isn't just a technical feature; it's a way to rebuild faith in a broken system.

Another point that resonated strongly was the idea of improved attribution and ownership. For an artist, the ability to permanently prove that a song is yours and that you created it on a certain date

is incredibly empowering. It's a powerful shield against people who try to steal or misuse their work. One musician I spoke to put it very simply, but very powerfully, that if they could just put their song on a system that says 'this is mine, forever,' they would feel so much more secure about their future. This feeling of security is something many artists currently lack, making blockchain's promise of permanent ownership incredibly appealing.

Then there was the excitement around automated payments via smart contracts. The idea of a system that automatically sends money to everyone involved in a song's creation, instantly and without someone else's approval, was a huge draw. It's a solution to the long delays and confusing calculations that artists currently face.

Of course, it wasn't all positive. People also raised some very real and practical challenges to adoption. They brought up the technical complexity of blockchain, the need for better digital skills, and the lack of proper infrastructure in many parts of Uganda. One musician's question really sums up this concern, as they wondered how someone in a village could possibly use it if they don't even have reliable internet. This question is a crucial reminder that any solution, no matter how innovative, has to be grounded in the reality of the people it's meant to serve. The technology has to be made accessible, or its potential will remain just that potential.

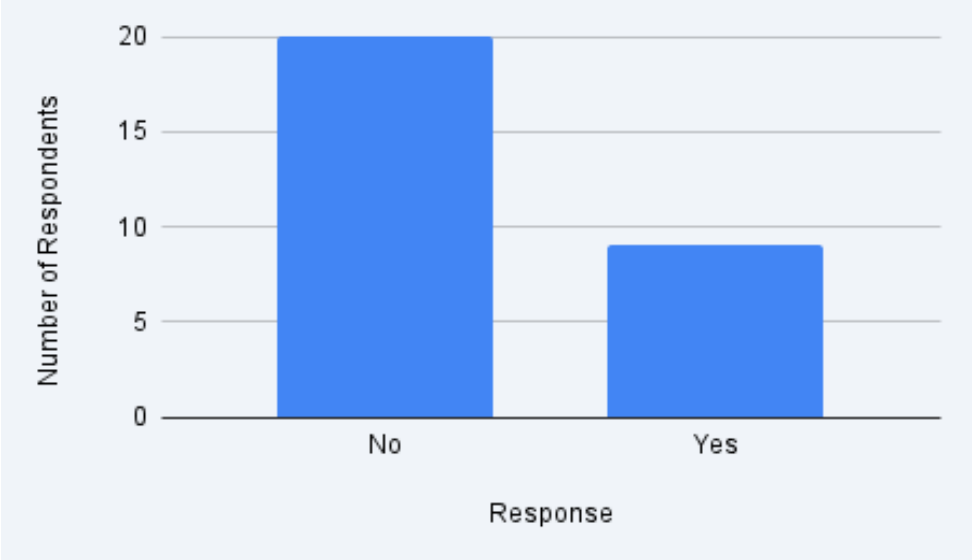

Fig 4.3: |Awareness of Blockchain Technology among musicians.

4.6 Framework Design: A Blockchain-Based Solution for Uganda's Music Industry

Based on the synthesis of challenges identified in Section 4.3 and the perceived potential of blockchain technology in Section 4.5, this study refined the design of a proposed blockchain-based framework, initially outlined in Section 3.1. The empirical findings from the qualitative and quantitative data collection informed specific features and considerations essential for its practical and effective implementation in the Ugandan context.

The most sought-after features musicians desire in a technology system designed to protect their music were clearly illustrated by the study's findings. A primary priority comprises automatic copyright registration, which indicates a strong need for streamlined and efficient processes to secure their intellectual property from the moment of creation. This feature directly addresses the complexity and bureaucracy associated with traditional methods. Following closely are transparent royalty distribution and real-time tracking of plays and downloads, which highlights the critical importance of fair compensation and the ability to monitor the usage of their work with unprecedented visibility.

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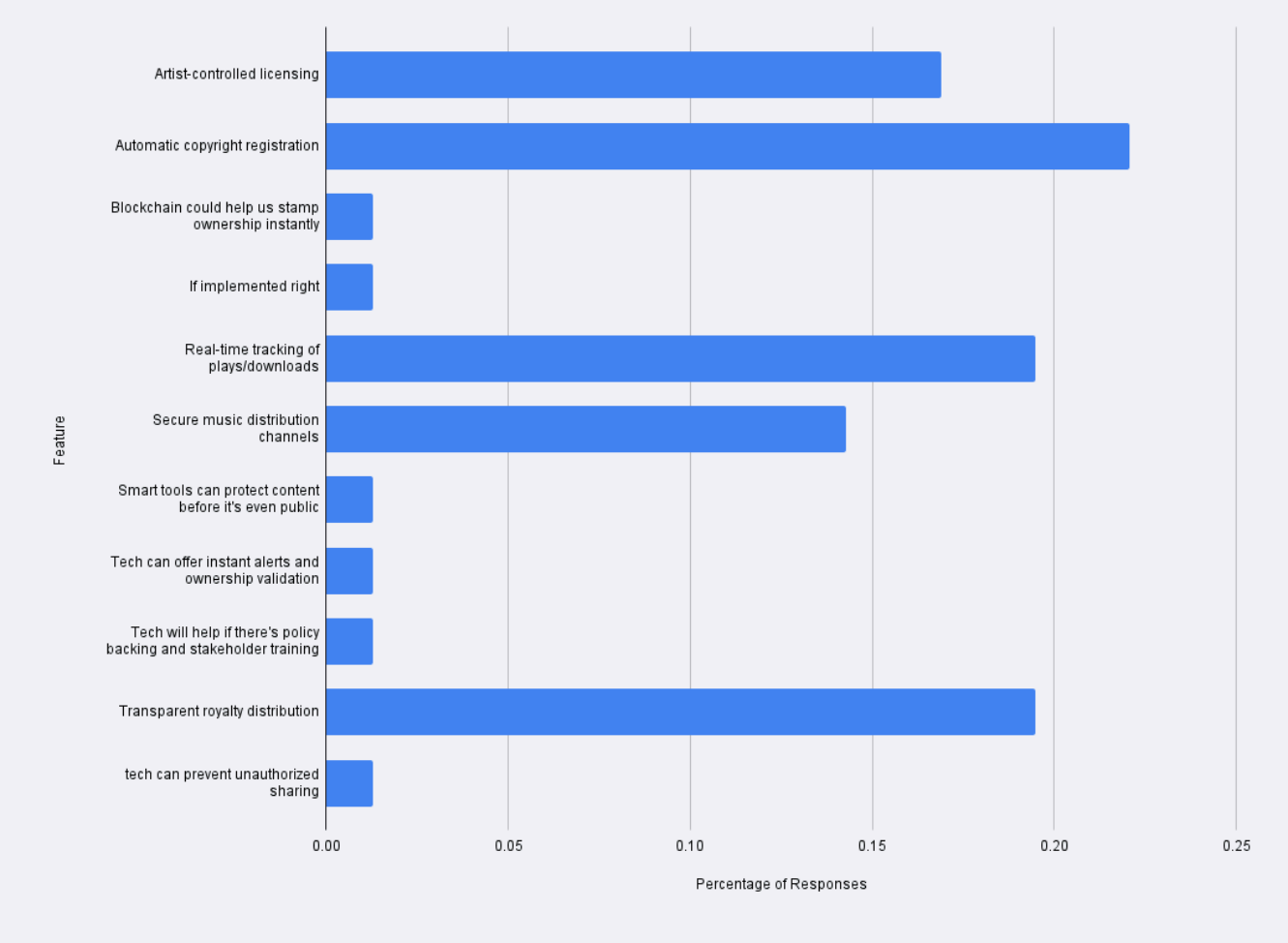

Fig 4.4: Desired features in a music protection technology system

Additionally, the framework's design incorporates other significant concerns, including artist-controlled licensing and secure music distribution channels. These features reflect musicians' strong desire for greater autonomy over how their music is shared and monetized. They also underscore the need for safe and reliable platforms to prevent unauthorized access and piracy. These prominent features collectively point towards a comprehensive vision for a music

protection system that leverages technology to address various aspects of copyright and revenue challenges. As one musician expressed, "We need a system that doesn't just promise to protect us, but one that actually puts us in control."

Furthermore, the data also includes a set of less frequently mentioned, yet still relevant, desires. These comprise the potential of blockchain technology for instant ownership stamping, the importance of policy backing and stakeholder training for effective technological implementation, and the need for smart tools that can protect content even before it is made public. Features such as instant alerts, ownership validation, and technology that can prevent unauthorized sharing underscore the demand for proactive and robust protection mechanisms. While these features were mentioned by a smaller number of respondents, they collectively point towards a holistic vision for a music protection system that leverages technology to address various aspects of copyright and revenue challenges.

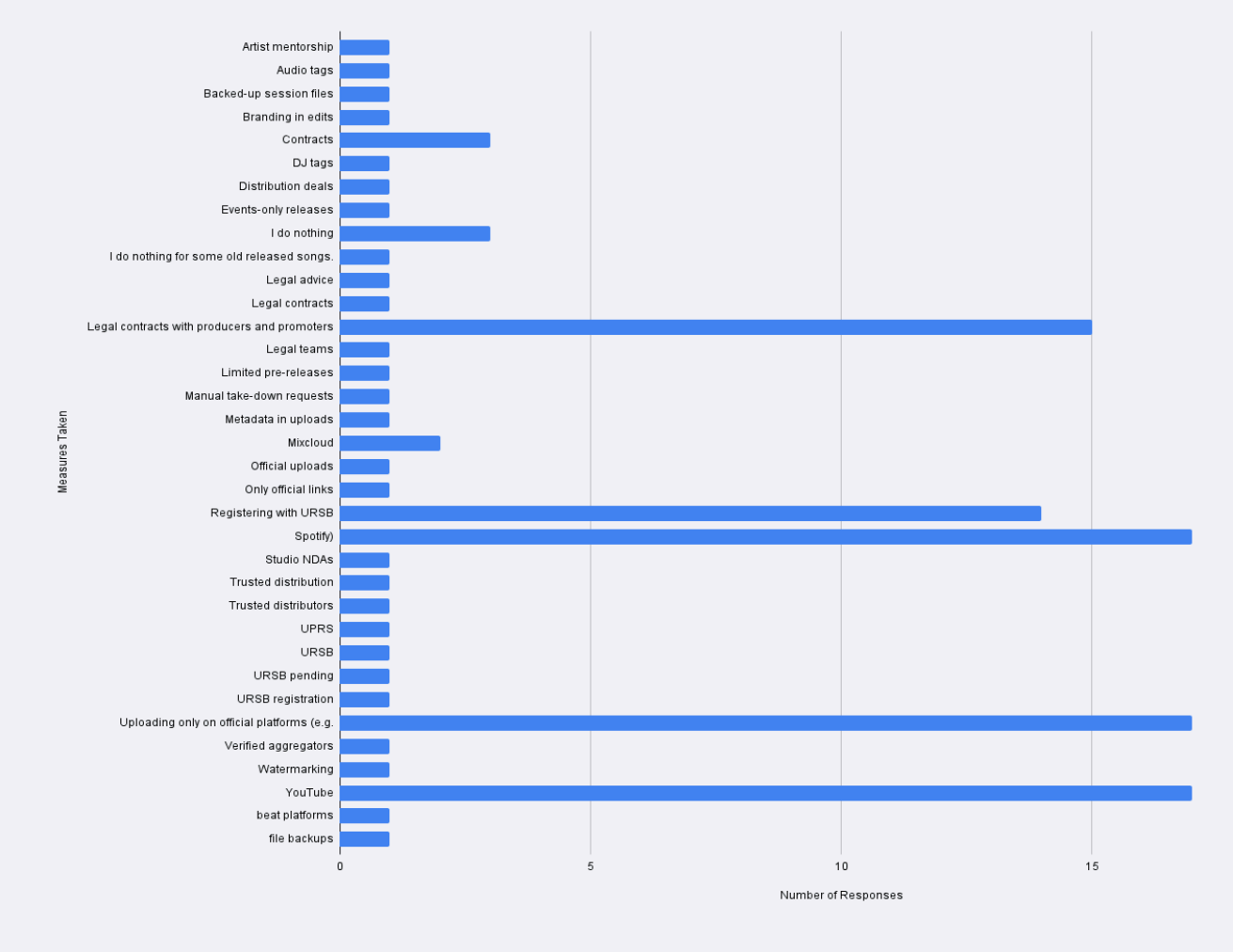

Fig 4.5: Measures taken by Uganda musicians to protect their music from copyright theft and income loss.

The analysis of the measures musicians currently employ to safeguard their music from copyright infringement reveals a varied landscape of approaches. Prominently, the practice of exclusively uploading content onto established official platforms such as YouTube and Spotify emerged as a dominant strategy, underscoring the perceived security and reach these platforms offer. This suggests a reliance on external, reputable services for protection, potentially due to a lack of accessible or effective internal mechanisms. Furthermore, the emphasis on formal legal

frameworks is evident through the significant number of musicians engaging in legal contracts with producers and promoters, as well as registering with the Uganda Registration Services Bureau (URSB). These findings highlight a dual approach to copyright protection: leveraging the infrastructure of digital platforms and adhering to formal legal and governmental processes.

Beyond these prevalent methods, the data also captured a spectrum of other measures, reflecting individual efforts and diverse understandings of copyright protection. While less frequent, practices such as utilizing Mixcloud, maintaining backed-up session files, embedding metadata in uploads, and employing verified aggregators point towards a more technical or administrative layer of protection. The mention of legal teams, distribution deals, and various forms of watermarking and audio tagging further illustrates the multifaceted nature of the challenges and the creative solutions being explored by musicians. Notably, some respondents indicated taking no measures, particularly for older releases, which could suggest a perceived lower risk for aged content or a lack of awareness regarding ongoing protection needs.

Collectively, these insights paint a comprehensive picture of the current practices within the Ugandan music industry concerning copyright theft prevention. The concentration of responses around official platform uploads and legal contracts suggests a move towards standardized, albeit externally dependent, protective measures. However, the array of less common strategies indicates an ongoing experimentation with various technological and administrative tools. This diverse set of approaches underscores the complexity of the copyright theft issue and the absence of a single, universally adopted solution, pointing towards a need for more integrated and accessible protection frameworks that can be easily adopted by all musicians, regardless of their resources or technical expertise.

The key components of the framework (Protection Registrar, Copyright Metadata Registry, Ownership Tracking Ledger, Smart Contracts, Royalty Distribution Engine, Usage Tracking and Auditing, Stakeholder Access Portal, Opportunity Tracking) were validated by the data's emphasis on transparency, automation, and immutable record-keeping. The preference for a permissioned blockchain model and hybrid on/off-chain storage (as discussed in 3.1.3 and conceptually tested in 3.5.1) was reinforced by the need for regulatory alignment and scalability

in the Ugandan context, identified through interviews with legal and industry professionals.

4.7 Causal Antecedents and Contextual Influences of the Proposed Framework

While this study employed a qualitative research paradigm, which does not rely on the strict delineation of quantitative variables, it did investigate several key factors that shape the problem of copyright infringement and the potential for a blockchain-based solution. These factors can be conceptually categorized to provide a clearer understanding of their roles within the ecosystem.

The conditions contributing to copyright infringement and revenue loss are referred to as causal antecedents. These encompass the circumstances that precede the problem and create the environment for it to thrive. In this study, such antecedents include the widespread lack of awareness regarding copyright laws, the inherent ineffectiveness of existing enforcement mechanisms, the prohibitive cost of legal recourse, the pervasive opacity in royalty collection systems, and the ease with which digital piracy can be executed. These factors collectively constitute the root causes that the proposed framework aims to mitigate.

Conversely, the direct consequences or results of these antecedent factors are the consequential outcomes. These represent the effects that the proposed framework is designed to alter. They include the high incidence of copyright infringement, the substantial revenue loss experienced by artists, the lack of trust in royalty distribution systems, the difficulty in proving ownership, and the inefficiency of dispute resolution processes. The success of the blockchain-based framework would be measured by its ability to demonstrably improve these outcomes.

The relationship between the causal antecedents and their consequential outcomes is influenced by mediating and moderating variables. These are the mechanisms through which the framework is intended to create change. Key examples include the transparency of record-keeping enabled by an immutable ledger, the automation of payments via smart contracts, the enhanced accessibility of copyright registration, the traceability of content usage, and the overall perceived fairness of the new system. These are the core operational principles that the blockchain solution would modify or leverage to transform the current ecosystem.

The study recognizes contextual and exogenous influences that, while not directly manipulated, set the broader environment in which the framework would operate. These include the established national legal framework, specifically Uganda's Copyright and Neighbouring Rights Act of 2006; the existing digital infrastructure and internet penetration rates; the level of digital literacy among artists; the socio-cultural attitudes towards intellectual property; and the operational landscape of dominant digital platforms like YouTube. The qualitative analysis revealed how these factors interact, providing critical insights that informed the design of a blockchain framework that is not only technologically sound but also contextually appropriate for fostering a more equitable and efficient ecosystem.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.0 Chapter overview

This chapter provides an extensive discussion of the study's findings, interpreting these results within the broader academic context and specifically addressing the unique dynamics of Uganda's music industry. It meticulously delineates the key conclusions substantiated by the evidence presented in Chapter Four, evaluates the significant ramifications of the proposed blockchain framework, and identifies promising avenues for future action designed to further bolster copyright protection and ensure sustainable revenue generation within the creative sector.

5.1 Discussion of Findings

The empirical findings derived from this study offer crucial insights into the persistent challenges of copyright infringement and the resultant loss of revenue encountered by Ugandan musicians. Simultaneously, these findings illuminate the considerable potential of blockchain technology as a transformative solution to these issues.

5.1.1 Reinforcing the Problem of Copyright Infringement

The collected data unequivocally corroborated the initial premise that copyright infringement constitutes a pervasive and substantial challenge within Uganda's music industry. The widespread occurrence of unauthorized content distribution, coupled with a prevalent lack of proper attribution and largely ineffective enforcement mechanisms, closely aligns with existing academic literature on intellectual property challenges in developing countries. In such contexts, digital piracy is frequently rampant, a phenomenon exacerbated by a combination of weak legal frameworks, limited enforcement capabilities, and a general deficiency in public awareness regarding intellectual property rights (Asekenye, 2019; Namara, 2021). Furthermore, the overwhelming dissatisfaction articulated by musicians concerning the current copyright structures

underscores a profound sense of frustration, thereby validating the urgent necessity for systemic reform. This sentiment distinctly mirrors findings from other African nations where conventional copyright management systems continue to grapple with issues pertaining to transparency and operational efficiency (Awka Journal of Research in Music and the Arts, 2024).

5.1.2 The Transformative Potential of Blockchain

The study's findings reveal a strong conceptual acceptance among various stakeholders regarding blockchain's inherent capacity to address the core challenges plaguing the music industry. The perceived advantages, including enhanced transparency, immutable ownership records, and automated royalty distribution, directly correspond to the identified pain points of opacity in financial flows, disputes over attribution, and delayed payments. This optimism resonates with the broader global discourse concerning blockchain's disruptive capabilities in intellectual property management. Here, its fundamental properties of decentralization, immutability, and programmability are increasingly recognized as pivotal for fostering fairer compensation models and strengthening rights enforcement (Tapscott & Tapscott, 2016; De Filippi & Wright, 2018). The conceptual validation of the framework, achieved through simulated YouTube scenarios, further illustrated how a hybrid blockchain approach could provide practical, context-specific solutions for a dynamic digital content ecosystem, such as that prevalent in Uganda.

5.1.3 Implications for the Ugandan Music Industry

The proposed blockchain framework holds significant implications for the Ugandan music industry, signaling a potential paradigm shift in how intellectual property is managed and monetized. Firstly, it offers the distinct potential for the empowerment of artists by providing verifiable proof of ownership and transparent royalty flows, thereby shifting control and greater autonomy back towards the creators. Secondly, the implementation of automated and equitable royalty distribution could lead to increased and more reliable revenue streams for musicians, consequently fostering tangible economic growth within the sector. Thirdly, enhanced industry trust could be cultivated through greater transparency in transactions and data management, serving to rebuild confidence among artists, collective management organizations, and other industry participants. Fourthly, the modeling of legal compliance within the permissioned

blockchain components highlights a pragmatic pathway for technology to support and reinforce, rather than circumvent, national legal frameworks—a factor crucial for successful and sustainable adoption in Uganda (Kaggwa, 2021). Lastly, by integrating features for immutable tracking and robust proof of ownership, the framework functions as a powerful deterrent against digital piracy and offers an effective tool for recourse against unauthorized use on platforms such as YouTube, thereby contributing significantly to addressing the pervasive challenge of digital piracy (Dorah, 2022; Digital Music News, 2023).

5.2 Conclusion

This study successfully investigated the intricate challenges of copyright infringement and revenue loss prevalent in Uganda's music industry, subsequently proposing a viable blockchain-based framework as a transformative solution. The rigorous qualitative analysis confirmed the pervasive nature of copyright violations and substantiated the widespread dissatisfaction among stakeholders with existing enforcement mechanisms and royalty collection systems. Key findings consistently highlighted the critical need for enhanced transparency, undeniable ownership verification, and efficient, automated payment systems.

The proposed blockchain framework, strategically incorporating a combination of public and permissioned blockchain types alongside smart contracts, underwent conceptual validation through simulated YouTube scenarios. This validation demonstrated its strong potential to: provide indisputable proof of ownership and origin for musical works; automate and render transparent the distribution of royalties based on actual content usage; maintain comprehensive and immutable audit trails for enhanced accountability; align technical controls seamlessly with Uganda's Copyright and Neighbouring Rights Act (2006); and ensure secure, role-based access for legitimate stakeholders.

In conclusion, this research unequivocally affirms that blockchain technology presents a promising and robust pathway to effectively mitigate copyright infringement and significantly improve financial fairness and transparency for musicians in Uganda. Its judicious implementation could foster a more transparent, efficient, and equitable digital music ecosystem, thereby contributing substantially to the sustainable growth and economic vitality of Uganda's

creative industries.

5.3 Limitations and Recommendations

This study, while offering a robust conceptual framework and generating valuable qualitative insights, acknowledges several inherent limitations that concurrently open numerous avenues for future action and development.

5.3.1 Limitations of the Study

Firstly, the conceptual modeling aspect of the study meant that the "testing" of the framework relied exclusively on theoretical simulations rather than a fully deployed, real-world blockchain prototype. While this approach was illustrative and instrumental in demonstrating potential functionalities, it inherently does not account for the myriad complexities and unforeseen challenges that could arise during actual technical implementation, real-world interoperability, and large-scale user adoption in a live operational environment. Secondly, due to its predominant qualitative focus, the methodology did not yield quantitative measures of impact. Consequently, the study could not provide precise data on, for instance, the exact reduction in piracy rates or the specific increase in artist revenue subsequent to the framework's hypothetical implementation. Thirdly, the study's scope was primarily concentrated on the music industry within Uganda and limited to conceptual YouTube scenarios. While certain findings and proposed solutions may possess broader applicability, it is important to recognize that specific challenges and optimal solutions might vary significantly across other creative arts sectors (e.g., film, visual arts, literature) or different digital content platforms. Finally, participant perceptions regarding blockchain's potential were inevitably influenced by their existing level of technological and blockchain literacy. This suggests that a broader, more in-depth educational initiative preceding such research might yield different, potentially more nuanced or informed, perspectives on its practical applicability and challenges.

5.3.2 Recommendations

Building upon the foundational insights derived from this study and acknowledging its limitations, several key areas for future action and development are strongly recommended to advance the practical implementation and impact of this framework:

It is recommended that Prototype Development and Pilot Implementation be prioritized. This involves transitioning from conceptual modeling to the actual development and pilot deployment of a functional blockchain-based platform specifically tailored for the Ugandan music industry. Such an initiative would necessitate selecting a suitable blockchain platform (e.g., Hyperledger Fabric), coding robust smart contracts, and conducting rigorous real-world performance testing with a limited group of artists and industry partners.

Furthermore, a detailed Technical Feasibility and Scalability Study is imperative. Such a study should comprehensively assess the infrastructure requirements, operational costs, and scalability challenges inherent in deploying such a system across Uganda, taking into careful consideration the varying levels of internet access and digital literacy across the country.

It is also recommended that further in-depth analysis be conducted on the Legal and Regulatory Framework for Smart Contracts under Ugandan law. This should encompass proposing necessary legislative amendments or formulating new policy guidelines to seamlessly integrate blockchain-based agreements into the national legal framework, potentially drawing comparative lessons from other African jurisdictions exploring similar innovations in legal technology (Kaggwa, 2021; Dorah, 2022).A comprehensive study on the Economic Viability and Business Model Development of the proposed framework is critical. This should include potential sustainable business models, funding mechanisms, and innovative revenue generation strategies for its long-term viability, alongside a meticulous assessment of transactional costs and their potential impact on artist earnings.

Additionally, it is recommended that research focus on User Adoption and Change Management Strategies among Ugandan musicians and industry stakeholders. This would involve systematically identifying potential barriers to adoption and developing tailored user onboarding

programs, effective training modules, and continuous support mechanisms to ensure widespread acceptance and optimal utilization of the blockchain platform.

Finally, it is recommended that future initiatives explore the Cross-Industry and Regional Expansion of this framework. This would involve examining its applicability to other creative industries in Uganda (e.g., film, visual arts) or its potential for regional integration across East Africa, thereby fostering a broader and more robust digital creative economy.By diligently pursuing these recommended actions, the insights established by this study can be built upon, contributing significantly to the practical realization of a more transparent, equitable, and prosperous future for Uganda's creative industries, fundamentally underpinned by blockchain technology.

References

1. 10. Zhu, K., Kraemer, K.L. and Xu, S. (2006b), The process of innovation assimilation by firms in different countries: A technology diffusion perspective on e-business, "Management Science", Vol. 52, No. 10, pp 1557- 1576.
2. 11. Philip E. Graves, Appropriate Fiscal Policy over the Business Cycle: Proper
3. 12. Michael Binder and Marcel Bluhm, On the Conditional Effects of IMF Program Participation on Output Growth, August 2010
4. 13. Michael Binder, Qianying Chen, and Xuan Zhang, On the Effects of Monetary Policy Shocks on Exchange Rates, August 2010
5. 14. Felix J. Bierbrauer, On the Optimality of Optimal Income Taxation, August 2010 Nikolaus Wolf, Europe's Great Depression – Coordination Failure after the First World War, September 2010
6. 15. Braun, V., & Clarke, V. (2024). *Thematic analysis*. In *Encyclopedia of quality of life and well-being research* (pp. 7187-7193). Cham: Springer International Publishing.
7. 16. Castleberry, A., & Nolen, A. (2018). Thematic analysis of qualitative research data: Is it as easy as it sounds? *Currents in Pharmacy Teaching and Learning, 10*(6), 807-815.
8. 17. Putz, Benedikt & Böhm, Fabian & Pernul, Günther. (2021). HyperSec: Visual Analytics for blockchain security monitoring. 10.48550/arXiv.2103.14414.
9. Andoni et al. (2019). Blockchain Technology in the Energy Sector: A Systematic Review.
10. Chen, L., Zhang, Y., & Wang, S. (2020). Multi-agent system for collaborative IEEE Access, 8, 40915-40924.
11. Mugambwa, S. (2018). Copyright Law and Practice in Uganda. Fountain Publishers.
12. Namakula, J. & Lumu, D. M. (2019). The challenges of enforcing intellectual property rights in Uganda's creative industry. Journal of Intellectual Property Law & Practice, 14(3), 223-236.
13. National Task Force Against Counterfeiting (NTFAC). (2022). Annual Report

2021-2022.

14. NIST. (2020). Blockchain Technology Overview.
15. Smith, J., & Jones, A. (2020). The Economic Burden of Copyright Piracy on the Creative Industries. Journal of Intellectual Property Law, 25(3), 456-489. doi: 10.1080/19914619.2020.1782341
16. Uganda Registration Services Bureau (URSB). (2023). Annual Report. https://ursb.go.ug
17. Uganda Registration Services Bureau (URSB). (n.d.). Intellectual Property. Retrieved from https://ursb.go.ug/intellectual-property
18. World Intellectual Property Organization (WIPO). (2022). Copyright in the Digital Age. https://www.wipo.int/web/ipday/2016/ip_digital
19. World Intellectual Property Organization (WIPO). (n.d.). Copyright. Retrieved from https://www.wipo.int/copyright/en/
20. Tapscott, D., & Tapscott, A. (2016). *Blockchain Revolution*. Penguin.
21. O'Dair, M., et al. (2016). *Music on the blockchain*. Middlesex University.
22. Reyna, A., et al. (2018). On blockchain and its integration with IoT. *Future Generation Computer Systems, 88*, 173–190.
23. Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2018). An overview of blockchain technology: Architecture, consensus, and future trends. *IEEE International Congress on Big Data*.
24. Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2018). An overview of blockchain technology: Architecture, consensus, and future trends. *IEEE International Congress on Big Data*.
25. Zhu, K., Kraemer, K.L., & Xu, S. (2006b). The process of innovation assimilation by firms in different countries: A technology diffusion perspective on e-business. *Management Science*, *52*(10), 1557-1576.
26. World Intellectual Property Organization (WIPO). (2022). *Copyright in the Digital Age*. Retrieved from https://www.wipo.int/web/ipday/2016/ip_digital.
27. Putz, B., Böhm, F., & Pernul, G. (2021). *HyperSec: Visual Analytics for blockchain security monitoring*. arXiv. doi: 10.48550/arXiv.2103.14414.

28. Namakula, J., & Lumu, D. M. (2019). The challenges of enforcing intellectual property rights in Uganda's creative industry. *Journal of Intellectual Property Law & Practice*, *14*(3), 223-236.
29. Uganda Parliamentary Forum for Creative Industries Seminar (Video 1): "Uganda Parliamentary Forum for Creative Industries Seminar Concludes with Copyright Law Announcement." Retrieved from https://youtu.be/lWN5O7g5dTc.
30. The Ugandan Podcast with Patrick Mugisha (Video 2): "The Ugandan Podcast: World IP Day Discussion with Patrick Mugisha." Retrieved from https://youtu.be/iD-hRFQScLk.

Appendices.

Questions
Timestamp
Full Name (Optional)
Stage Name / Art Name (Optional)
Age Bracket
Gender
Region of Residence / Operation in Uganda
Years Active in the Music Industry
What genre(s) of music do you mostly create or perform?
Have you ever had your music used or distributed without your permission?

If yes, please briefly describe the situation and how it affected you.
What measures do you currently take to protect your music from copyright theft?
Are you satisfied with the current structures in place to protect musicians from copyright theft in Uganda?
What are the biggest challenges you face when it comes to earning revenue from your music? (Select all that apply)
Have you ever heard of blockchain technology?
If yes, what is your current understanding of blockchain and how it can be used in the music industry?
Would you be interested in learning how blockchain could help protect your music and ensure fair earnings?
What features would you want to see in a system that protects your music using technology? (Select all that apply)
Do you think technology can play a role in solving copyright and revenue problems in Uganda’s

music industry? Why or why not?
Would you be willing to participate in a short interview or focus group discussion for further insights?
If yes, please provide your WhatsApp number or email for follow-up.

Table 5.1 :The questions included in the questionnaire administered to music industry stakeholders.

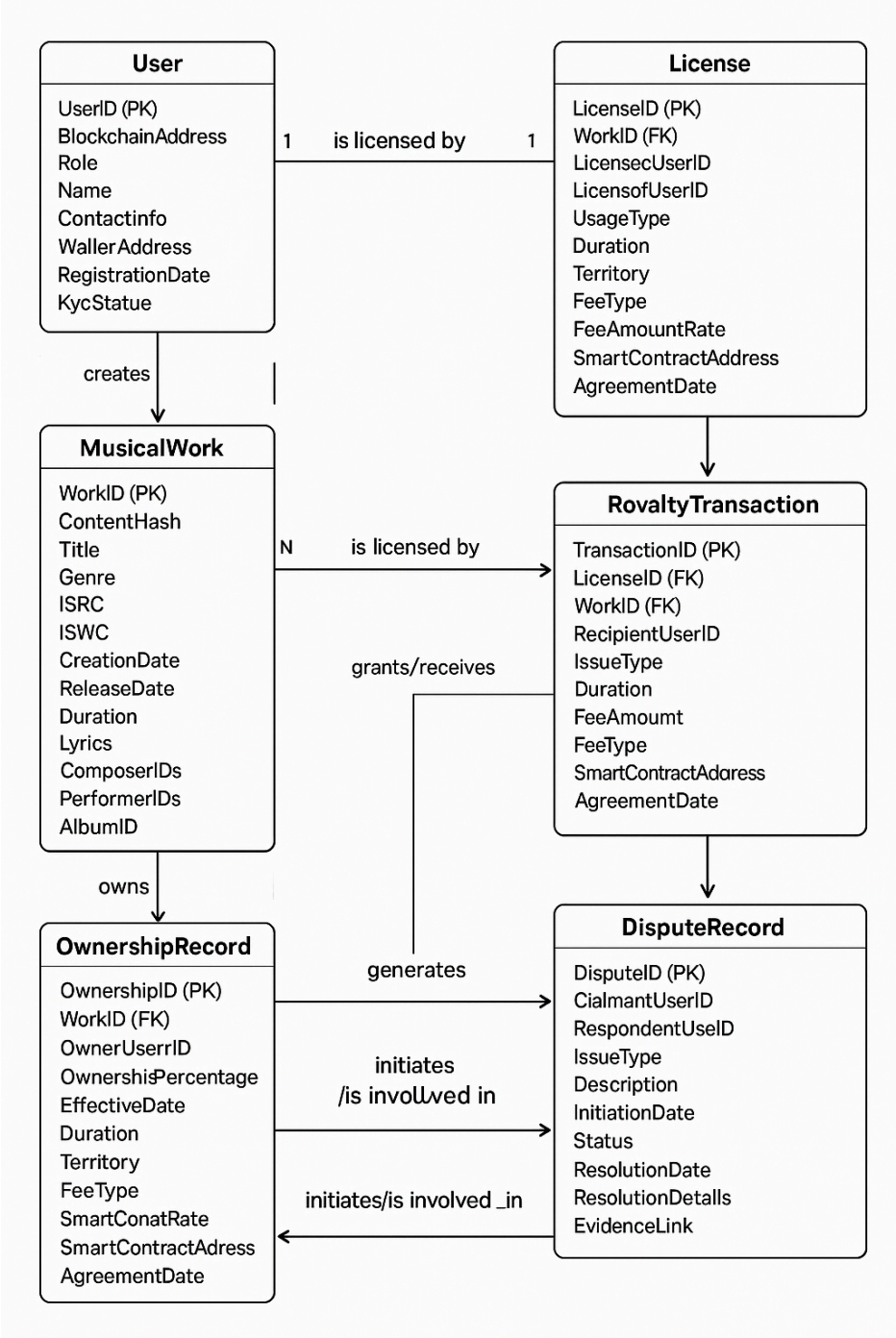

Fig 5.1: An ERD- Entity Relationship Diagram of the designed framework.

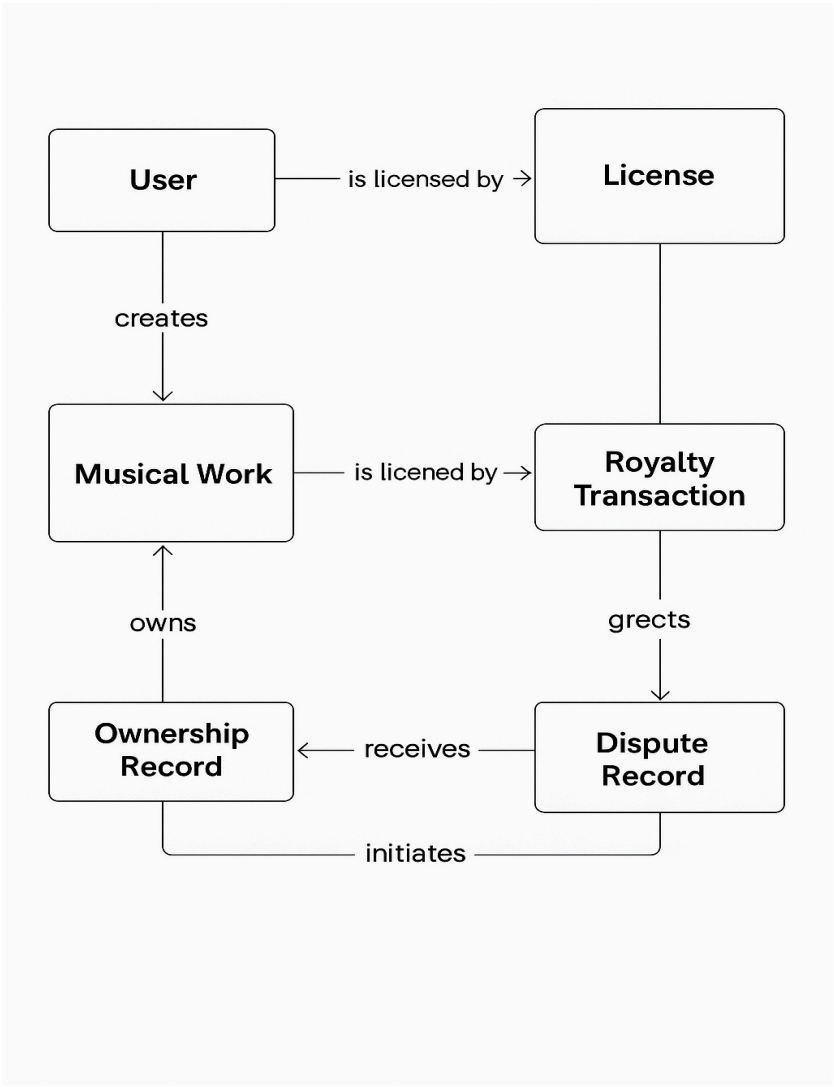

Fig5.2 : Data Flow Diagram of the designed framework.